NEW YORK
STATE DEPARTMENT OF HEALTH

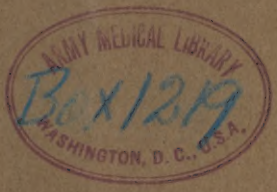
Edward S. Godfrey, Jr., M.D.
Commissioner

LABORATORY MANUAL

FOR

PHYSICIANS

Aids in Diagnosis and Treatment



Issued by
DIVISION OF LABORATORIES AND RESEARCH
ALBANY
Augustus B. Wadsworth, M.D., Director

1940

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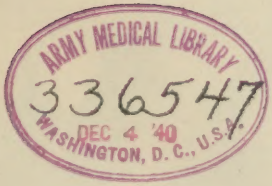

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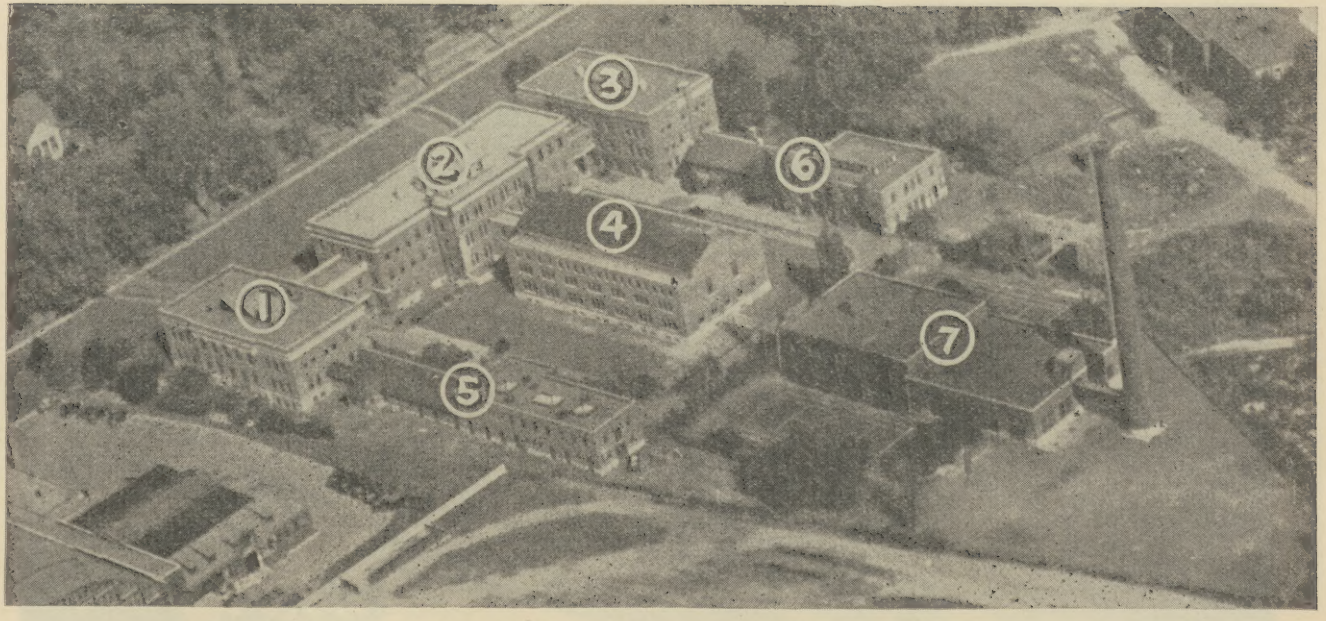
June, 1940

DIVISION OF LABORATORIES AND RESEARCH

North Façade Main Building, East and West Wings, New Scotland Avenue, Albany. Occupied successively 1919, 1924, and 1929.



DIVISION OF LABORATORIES AND RESEARCH

Airplane View of Laboratories and Auxiliary Structures, New Scotland Avenue, Albany, 1939.

1. West Wing: Antitoxin, Serum, and Vaccine Laboratories; 2. Central Building: Administration, General Services, and Research; 3. East Wing: Diagnostic Laboratories; 4. South Wing: Media Department, Library; 5. and 6. Animal Units; 7. Power Plant, Carpenter and Machine Shops.

DIVISION OF LABORATORIES AND RESEARCH

STATE DEPARTMENT OF HEALTH

Central Laboratory, New Scotland Avenue, Albany
Branch Laboratory, 339 East 25th Street, New York

AUGUSTUS B. WADSWORTH, M.D., *Director*

MARY B. KIRKBRIDE, SC.D., *Associate Director*

Antitoxin, Serum, and Vaccine Laboratories

HAROLD W. LYALL, Ph.D., *Assistant Director in Charge*

Diagnostic Laboratories

RUTH GILBERT, M.D., *Assistant Director in Charge*

FRED W. STEWART, M.D., *Principal Diagnostic Pathologist*

Branch Laboratory, New York City

EDGAR M. MAILLARD, M.D., *Associate Diagnostic Pathologist*

Laboratories for Sanitary and Analytical Chemistry

F. WELLINGTON GILCREAS, *Associate Sanitary Chemist*

Anna M. Sexton, *Librarian*
Ila M. Dutton, *Administrative Officer*
Lilian C. Smith, *Secretary to the Director*

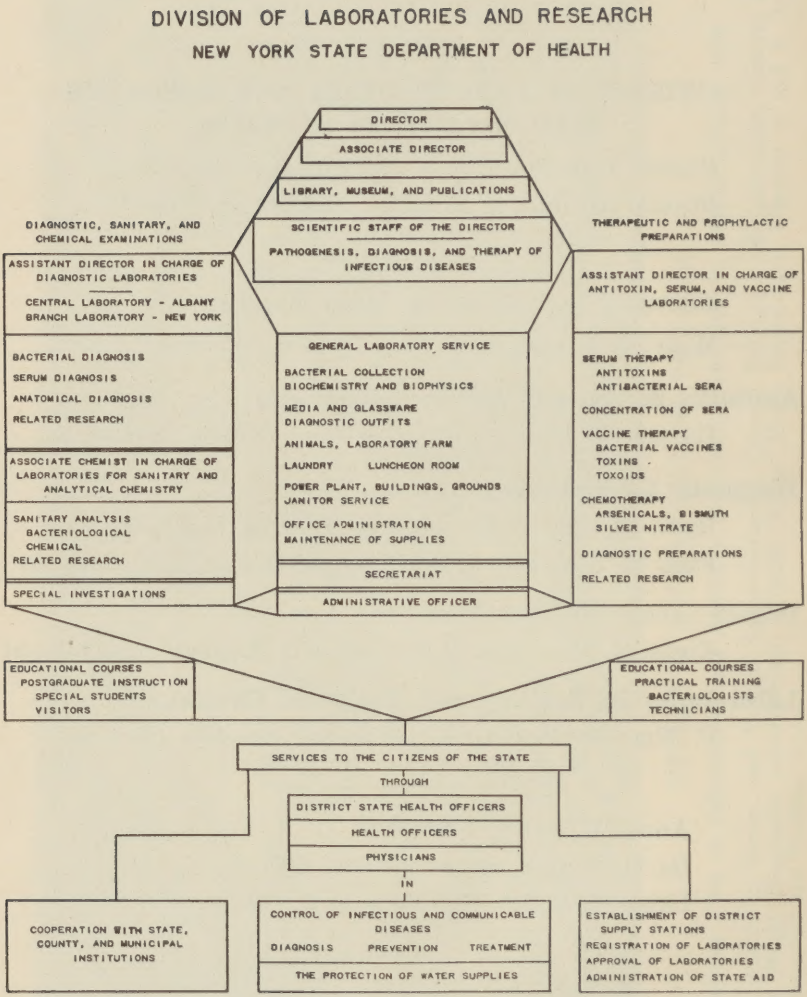


FIG. 1. Chart of Organization

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INTRODUCTION

Modern medicine depends upon laboratory service. That disease is a reaction to injury—a biologic process rather than an entity—has been recognized only since the discoveries of Pasteur and his demonstration of the analogy between fermentation and infectious disease. This conception is not limited to any particular group of ailments but has become so broad and inclusive that it is no longer possible to distinguish the border line between health and disease. The actions and reactions of the two states do not differ fundamentally, in fact the processes may be quite similar in nature, varying more or less only in degree. The character and extent of the injury, in general, determine the nature and severity of the disease.

The internist often finds it difficult to differentiate the disturbances of metabolism that characterize certain diseases until, during their later stages, the abnormal extent of the changes becomes manifest. The psychiatrist, too, often finds even greater difficulty in his field.

The infectious diseases, perhaps, provide an opportunity for a sharper differentiation, because the injury is incited by a foreign agent, the presence of which may be detected. But often the infectious agent may lodge in the tissues and persist without giving rise to disease, or may continue an abated development after the morbid processes have subsided and health has been restored. The carrier state is, with but few exceptions, common to all infectious diseases.

The incitant of an infectious disease gains access to the tissues through a portal of entry which varies with different species and depends, to some extent, upon exposure. Having gained access to the tissues, the parasite must develop in its new environment to produce substances that injure the tissues. The reaction of the tissues, following this injury, is the disease which we recognize by various signs, depending upon the nature of the processes. In the course of the disease the tissues develop activities that may not only inhibit and destroy the incitant but also neutralize specifically the particular poisons produced by it—activities that are lacking or latent under normal conditions.

Medical science has investigated and developed methods of detecting the poisons and determining the character and distribution of the substances that incite injury, and also, within certain limitations, the character and extent of the reactive processes that constitute the disease. Thus it is that laboratory aids to diagnosis and treatment have been formulated as the investigations have progressed.

The nature of the disturbances of metabolism in many of the constitutional diseases has not been adequately determined; only certain changes in the processes have been detected, as, for example, in diabetes, the increased percentage of sugar in the blood and its presence in the urine, resulting from the inhibition of the carbohydrate metabolism of the tissues. In infectious diseases, on the contrary, definite incitants have been recognized. In diphtheria, for instance, the diptheria bacillus has been isolated in pure culture and fully identified, as has also the toxin it produces in the tissues which incites the disease. The specific nature of the disease processes and the conservative effect of the immune reaction in neutralizing the toxin of the foreign incitant, have been fully elucidated; preventive inoculation and antitoxin therapy have long been practiced and, within certain limits, are specifically effective.

The laboratory aids for the diagnosis and treatment of diabetes are, therefore, limited to chemical tests of blood and urine, but in diphtheria, the presence of the bacillus may be detected by bacteriologic examination in any of the processes from which the disease arises. The degree of individual susceptibility to diphtheria may be determined by testing the activity of the tissues in neutralizing the toxins of the bacillus. The tissues of susceptible persons may be so immunized by the introduction of toxoid in graduated doses that they are no longer susceptible to diphtheria. Horses can be immunized and the blood serum from these animals, which contains antitoxin, may be injected into the tissues of a person suffering from diphtheria, and thus supplement or augment the activity of these tissues in neutralizing the poison that is giving rise to the disease. Diphtheria thus strikingly illustrates the achievements that result from the laboratory study of infectious disease and the extent to which laboratory aids may figure in the diagnosis, prevention, and cure of the disease as it occurs in the individual or in epidemic form.

Research on the other infectious diseases has advanced our knowledge and developed many practical aids to diagnosis and treatment that are now essential to health officers in their administrative

activities, and to physicians in their practice. Obviously, according to present-day standards, any community that lacks laboratory service is seriously handicapped. The citizen ultimately benefits from the development of laboratory service. The application of these scientific methods has a far-reaching educational influence that is essential to the maintenance of the highest standards of medical practice in any community, and provides a background that cannot fail to inspire confidence.

PART I

PUBLIC HEALTH LABORATORY SERVICE IN NEW YORK STATE

The Division of Laboratories and Research in its present form began, as a successor to the earlier State Hygienic Laboratory, with the reorganization of the State Department of Health in 1913–1914. With a staff of less than twenty, the work was done in a small frame building and a remodeled stable on Yates Street, in sharp contrast to the modern, well-equipped buildings it now occupies in the pursuit of its statewide activities. In 1919 the laboratory moved into the new main building on New Scotland Avenue; in 1924, the east wing was opened, chiefly for the use of the diagnostic laboratories, and in 1929 the antitoxin, serum, and vaccine laboratories were transferred to the new west wing. In that year a power-house and two new stable units were also constructed. Early in 1939 the south wing, which houses the media department and the library, was occupied. (See Plates I and II.) The Laboratory farm, within a few miles of Albany, has undergone a parallel development. The plant there now includes a large main unit and five additional buildings for separate phases of the work. This building program offers an excellent illustration of the expansion of the work year by year, for each addition has been a necessary step in the advancement and maintenance of efficient service.

There is only one branch laboratory of this Division, established in 1914 and now located at 339 East 25th Street, New York, in close proximity to the important medical centers; it serves districts on Long Island and in the vicinity of New York, which are less accessible to the Albany laboratory than are other parts of the State. The approved laboratories scattered throughout the State, serving the larger cities and most of the counties, provide close contact between the health officers and physicians and the central laboratory. Many technical diagnostic procedures must be performed at the bedside or in a laboratory nearby. The close contact thus afforded is an important factor in effective laboratory service; its development supplements the facilities offered by the central laboratory and the branch.

The expanding laboratory service in New York State has presented an interesting problem because of the uneven distribution of

the population. The State now has a service that is unique in the extent to which it reaches the citizens of the various districts. The close cooperation between the approved laboratories and the central laboratory in Albany tends to ensure uniform methods and reliable results.

This manual outlines the organization and operation of the laboratory service offered by the State, and contains information as to how physicians and health officers can avail themselves of it. The Public Health Law and the Sanitary Code should be consulted when there is any doubt concerning legal requirements or provisions.

Approved Laboratories

The function of the laboratory is to assist physicians, health officers, and through them citizens of the State in general, in the prevention, diagnosis, and control of disease. To attain the highest efficiency it must be developed to meet the needs of the district served, and physicians and health officers should be thoroughly familiar with the facilities available.

The regulations of the Sanitary Code of the State require physicians to submit specimens from certain of the communicable diseases, as well as tissue removed at operation or at necropsy that requires laboratory examination as an aid in the diagnosis, prevention, or treatment of disease or to determine the cause of death, to a laboratory approved by the State Commissioner of Health for the examination of such specimens (Sanitary Code, Chap. II, Reg. 9; Chap. IV, Reg. 7). Specimens of blood from applicants for a marriage license and from pregnant women must also be submitted to an approved laboratory for serologic tests for evidence of syphilis (Domestic Relations Law, Art. II, Sec. 13-a; Public Health Law, Art. II-A, Sec. 18-d). There are approximately one hundred and twenty approved diagnostic laboratories in New York State, outside of the city of New York; these include county, city, hospital, and private laboratories. Only a few of them have not received approval for the examination of specimens of tissue.* A pamphlet in regard to local laboratory service, which includes a list of laboratories and the examinations for which approval has been issued, is distributed annually to registered physicians in the State outside of the city of New York.

* The Sanitary Code of New York State is effective in all sections of the State except the city of New York. If directors of laboratories there wish to act as consultants or to examine specimens from patients living outside of the City, approval is granted if proper standards are met.

When the need for local service has been realized in a community, the first step is usually the appointment of a committee by the county medical society to ascertain the apparent and probable demand, and to determine the various and most feasible means by which laboratory service may be secured, and the approximate cost. State aid is provided for county and city laboratories meeting certain requirements. Also, if efficient laboratories are conveniently located, service may be procured through contract.

Laboratories are maintained under such varying conditions that it is difficult to formulate a budget for general application. Quarters, light, and heat may be exchanged for service, and in some instances, initial equipment has been contributed by public-spirited citizens. Salaries of workers depend upon training, experience, and skill. The following are estimates of the probable cost, which varies according to the scope of the work and the size of the district served.

Director (graduate in medicine with adequate training in pathology and bacteriology)	$5,000	$6,000	$8,000
Associate or assistant director (graduate in medicine)		3,000	5,000
Chemist		3,000	4,000
Technician	1,200	1,500	2,000
Technician		1,200	1,200
Technician		1,200	1,200
Cleaner and helper	900	900	1,200
Cleaner and helper		900	900
Clerk	1,200	1,200	1,200
Secretary			1,800
*Rent		?	?
*Fuel, light, water, etc			1,000
Supplies	500	1,000	2,500
Travel	150	300	500
	$8,950	$20,200	$30,500
Cost of initial equipment	2,500	3,500	6,000
	$11,450	$23,700	$36,500

When the necessary data have been secured, the committee appointed by the county medical society should present the facts

*This amount would depend upon the location of the laboratory.

and the request for an appropriation to cover the desired service to the board of supervisors of the county or the common council of the city. It is usually a mistake, however, to go before an appropriating body with a project of this kind without first having conducted an active campaign of publicity and education among physicians and other residents of the district to be served. Much valuable information and advice may be obtained by consulting the district state health officer.

An amendment to the Public Health Law (Art. III, Sec. 20-c-h), enacted in 1923, authorizes boards of supervisors in counties, and the common council or any body exercising similar powers in cities, to establish laboratories or provide laboratory service, for which state aid may be granted. A sum of $2,500 for initial installation and equipment and one-half the cost of yearly maintenance not in excess of $7,500 may be furnished. A laboratory established under this act must have a board of managers consisting of at least five members representing the various interests in the district served, two of whom are physicians. An amendment to this law, effective April 30, 1930, authorized the board of supervisors to confer the powers and duties of the board of managers upon the county board of health if such a board exists.

Before a laboratory can be approved, the director must have the qualifications outlined in the Sanitary Code (Chap. XI, Reg. 18–24).

At a meeting on January 15, 1937, the Public Health Council adopted the following resolution relating to the approval of laboratories: "Resolved, that, diagnostic laboratory service being intimately concerned with the practice of medicine, the state commissioner of health be advised that a laboratory offering diagnostic service should not be approved unless, in addition to meeting other conditions which may be prescribed, the person actively in charge is licensed to practice medicine or eligible for examination for license to practice medicine in the State of New York."

Approval of Laboratories

Procedure

Approval of a laboratory is considered by the Division of Laboratories and Research after an application has been made by the person in charge, and is issued only in case the applicant has qualifications that meet the requirements prescribed by the Sanitary Code, has demonstrated his ability to perform the duties of the position satisfactorily, and agrees to conduct the work of the laboratory in an ethical manner and to maintain the technical standards required for laboratories approved under the authority of the Commissioner of Health.

Four years of postgraduate training and experience in the department of pathology of a medical school recognized by the Regents of the University of the State of New York, including training and experience in pathology, bacteriology, and related departments, or an equivalent combination of training and experience have been considered as meeting the requirements for directors and pathologists outlined in Regulations 21 and 22 of the Sanitary Code.

Directors, pathologists, and bacteriologists shall either be on full time or devote the major part of their time and attention to the work of the laboratory. When they cease active laboratory work for a long period of years, their qualifications must be reviewed in the light of advances in knowledge in bacteriology and pathology that have taken place in the interim, before approval is issued.

The facilities available for conduct of the work for which approval is desired, including space, lighting, and equipment must be adequate.

Certificates of approval are issued annually. They are valid until the end of the year in which issued unless sooner revoked. The approval will terminate automatically with changes in the personnel in charge of work for which approval has been issued. The laboratory examinations for which approval is granted are specified. New appointees must qualify in the usual manner.

Series of specimens are submitted for comparative examination from time to time to the different approved laboratories and also upon the request of a director.

A person in charge of a laboratory seeking approval submits a formal application and signs agreements regarding the maintenance of standards of work. The laboratory is then inspected by a representative of the central laboratory at which time applicants for approval in pathology examine a series of approximately fifty sections of tissue that have been selected with special care. Only those sections are used upon which the pathologists of the State Institute for the Study of Malignant Diseases in Buffalo and of the Division of Laboratories and Research are in complete agreement as to the character of the lesion and the suitability of the material for the purpose.

The Sanitary Code specifies that bacterial milk counts used for the purpose of grading shall be made only in laboratories approved for the examination by the State Commissioner of Health (Chap. III, Reg. 5). Certificates of approval are issued to meet the needs of the local health authorities, provided the equipment in the laboratory is adequate, minimum standards are met, and the data concerning the qualifications of the person in charge of the work indicate that he is competent. Because of the value of the phosphatase test in the control of the sanitary quality of milk supplies, approval for bacteriologic examinations is granted only to labora-

tories in which it is demonstrated that the phosphatase test can be made satisfactorily.

Laboratory examinations of eating, drinking, and cooking utensils that are necessary to determine compliance with the Code (Chap. XIV, Reg. 3) must be made in laboratories approved for the purpose, and certificates are issued under conditions similar to those outlined in the approval for milk examinations.

A like policy is followed in the approval of laboratories for the examination of samples of water, although the Sanitary Code does not require the submission of such specimens to an approved laboratory.

Article XXIII of the Public Health Law requires the registration of places where cultures of pathogenic microorganisms or viruses are handled. This law has no bearing on the approval of laboratories but provides for the compilation of a list of addresses where strains of the incitants of disease are maintained.

PART II

LABORATORY AIDS IN THE DIAGNOSIS AND TREATMENT OF DISEASE

With the development of approved laboratory service, the scope of the work is gradually being extended to include all types of examinations that are helpful in the diagnosis and treatment of disease. In every case, however, the results of laboratory examinations must be interpreted in the light of clinical observations; the ultimate diagnosis rests with the physician.

Submission of Specimens

Every effort should be made to avoid the possibility of an interchange of specimens before mailing and to ensure their prompt delivery to the laboratory in a satisfactory condition.

Specimen Outfits

Much time and effort have been expended in an attempt to provide suitable outfits so that specimens will reach the laboratories in the best possible condition. The importance of selecting the proper outfit cannot be too strongly emphasized. The labels on the mailing cases used by the Central Laboratory and by many of the approved laboratories are marked to indicate the type of examination desired, as "D" for diphtheria. This not only facilitates the sorting of the specimens at the laboratory, and their distribution to the various groups for examination, but also ensures proper handling when they are received after working hours. For example, a mailing case labeled "D" for diphtheria, if received after 5:00 p. m., is placed in the incubator by the night janitor, together with a record of the time it was received. The reporting of the results of the examination are thus facilitated because there is no delay in incubation.

The Central Laboratory in Albany provides outfits designed especially for the collection of specimens to be examined for evidence of diphtheria, enteric disease, gonorrhea, syphilis, and tuberculosis. Miscellaneous outfits are designed for the collection of material from conditions other than those mentioned. All of these outfits may be secured from the district laboratory supply stations

maintained throughout the State. In districts where approved laboratory service is available, the supply stations distribute outfits furnished by the approved laboratories for the submission of specimens to them; in addition, a limited number of the State outfits is also available in the event that the physicians wish to submit duplicate specimens to the Central Laboratory .

In order to facilitate handling the large volume of specimens received for serologic tests for evidence of syphilis and to guard against possible delay that may render the specimens unsatisfactory for other desired examinations, the following procedure is recommended in sending specimens either to the Central Laboratory in Albany or the Branch Laboratory in New York:

Use the outfit with the cherry-colored label, marked "V," when blood is to be examined for evidence of syphilis.

When blood from the same patient is also to be subjected to another type of examination, such as an agglutination test for evidence of typhoid fever, submit, if possible, a separate specimen in the appropriate outfit.

If for some reason this cannot be done, always place in the outfit accompanying the specimen two forms giving adequate data relating to the case, one, a white, syphilis history form, the other, a pink, miscellaneous form. A supply of the miscellaneous history forms is available in all laboratory supply stations.

Blood-Letting Needles

The outfits furnished to physicians by the Division of Laboratories and Research for the submission of specimens for serologic tests contain blood-letting needles. They are not included in outfits sent to clinics and institutions. The needles are expensive and, in order that their distribution may be continued, physicians are asked to return them to the laboratory with the specimens, for reconditioning. A small envelope is furnished with each outfit, in which the needle can be placed after use; sufficient space is provided in the mailing case for enclosing the envelope with the specimen for mailing to the laboratory. Since the blood-letting needles have, in general, proved more satisfactory than syringes for collecting specimens, physicians are urged to cooperate in the maintenance of this service. (See Plate V, p. 74.)

Information or History Forms

An information or history form, as well as directions for collecting specimens, accompanies each diagnostic outfit. On this history form the physician should give pertinent data so that it will

be possible to determine the types of laboratory examinations that will be most helpful. Some of the information is required by law; some is needed for the guidance of laboratory workers; all of it, studied collectively with large numbers of records at hand, furnishes valuable data regarding the relative efficiency of the procedures commonly used. Inconvenience and loss of time for the physician, patient, and laboratory worker may result from lack of sufficient information.

To avoid the possibility of an interchange of specimens and information forms, either before mailing or during transit, the identification of the patient should always be written on the culture tube or other specimen container, as well as on the history form. Results of examinations can be reported only when the full name of the patient is given or, in the case of chancroid, gonorrhea, and syphilis, the patient's initials and date of birth. Physicians should take special care to record such data legibly. All information regarding a specimen should accompany it if possible. If a letter is written separately, it should include the identification of the patient, a description of the specimen, the date of collection, and the type of examination desired.

Preparation of Specimens

In the preparation of specimens, it is exceedingly important that certain simple rules and precautions be observed. Directions for the collection and the preparation of specimens that accompany the outfits should be read and followed. Moreover, the person preparing specimens for examination should be so familiar with the appearance of the outfits and material that he will know when they are not satisfactory for use.

The following precautions are among those to be observed: careful packing of specimens to avoid breakage and leakage; the use of medium that is neither liquefied nor dried; in the preparation of cultures, proper application of the swab to the surface of the lesion and thorough inoculation of the medium; careful handling of the swab used in collecting a specimen to prevent its coming in contact with surfaces other than those to be cultured; the preparation of thin films of blood or discharge so that they will be sufficiently translucent for microscopic examination; the submission of sufficient material, as in the case of specimens of blood for serologic tests; the proper care of syringes used in collecting blood, in order to avoid hemolysis of the specimen.

After specimens have been prepared, they should be mailed or delivered to the laboratory promptly, for many are spoiled because of delay in mailing or length of time in transit. If kept at room temperature, blood specimens may become hemolyzed, throat cultures overgrown with contaminating microorganisms, and, in the case of fecal specimens, bacillary incitants of enteric disease may be destroyed by the products of decomposition.

Postal Laws and Regulations

The observance of certain postal laws and regulations regarding the kind of specimens admitted to the mails, the containers to be used, and directions for packing will expedite delivery (U. S. Postal Laws and Regulations, Section 589). Specimens for laboratory examination may be admitted to the mail only when enclosed in mailing cases constructed in accordance with this regulation. Upon the outside of every such package should be written or printed the words, "Specimen for bacteriologic examination. This package should be pouched with letter mail." The packages are then handled as first-class matter, but are subject to third-class postage rates unless weighing over eight ounces, when the fourth-class rate applies.

PROPHYLACTIC AND THERAPEUTIC PREPARATIONS

General Information and Directions

Antitoxins, sera, and vaccines are prepared, tested, and distributed by the Division of Laboratories and Research. These preparations may be obtained by physicians from local supply stations. Certain preparations such as silver nitrate solution, antianthrax serum, and rabies vaccine, prepared elsewhere, are purchased for distribution. Besides these supplies, the central laboratory prepares for use in the local approved laboratories a large number of sera for diagnostic purposes.

Under no circumstances are any of the antitoxins, sera, vaccines, or other preparations distributed by this department to be sold. A violation of the above rule will subject the violator to the penalty prescribed by Section 1740 of the Penal Code.

Distribution of Preparations

The district supply stations and their substations are so located throughout the State as to afford the greatest facilities to health officers and physicians. Many of the stations are in the approved laboratories. The proper care of the prophylactic and therapeutic preparations in the stations is prescribed and monthly reports are sent to the laboratory in Albany, giving the name and address of the physician, the kind, amount, and lot number of the material obtained, and whether any was returned unused. The local stations are expected to maintain an adequate supply of routine material, such as diphtheria antitoxin, outfits of silver nitrate solution, etc., to meet the usual needs, and enough of certain products, such as tetanus antitoxin for therapeutic use and antimeningococcus serum, for the initial injections of one or two cases before a fresh supply from the State laboratory can be secured by telephone or telegraph. Still other products which are relatively unstable or seldom used, or new products upon the use of which further data are required before they are released for general distribution, can be secured only upon special request made through the local station or directly to the laboratory in Albany.

According to a recent amendment to section 1262, subdivision 2, of the Education Law, osteopathic physicians who have been certified by the State Board of Regents are granted the right to use antitoxins, sera, and vaccines but are not permitted to administer drugs (for example, arsenical and bismuth preparations).

Health officers and physicians can be of great assistance in conserving State supplies by limiting their requests to material actually needed for current use, by keeping under proper conditions any material held for a time, and by returning all unused material promptly to their local supply stations or, in the case of special products, to the central laboratory.

All biologic products should be kept in the dark at a low, even temperature; under no circumstances at room temperature or subject to marked temperature changes. It is inadvisable to use any material that has been frozen; it should be returned with this information. Material that has been kept under improper conditions cannot be relied upon to give satisfactory results. Products should not be used after the return date that is stamped on each package.

Precautions against Anaphylactic Reactions

The injection of horse or rabbit serum, whether concentrated or unconcentrated, may, in rare instances, incite severe or even fatal reactions of an anaphylactic character in highly sensitive persons. Such reactions usually occur in persons who suffer from hay fever, asthmatic or other allergic symptoms, or who have previously received an injection containing the corresponding serum. Hence, it is highly important to obtain the previous history and to determine whether a condition of hypersensitivity exists. For this purpose both an intracutaneous and an ophthalmic test are used. The intracutaneous test on account of its greater sensitivity should be selected if only one test is made. Even in persons who fail to react to the tests, intravenous or intraspinous injection of serum may induce severe or fatal reactions. Absence of systemic reactions when skin sensitivity has been demonstrated has also been reported. Although rare, the possibility of reactions makes caution essential in all serum injections. A syringe containing 1.0 ml. of freshly prepared epinephrine (Adrenalin) solution, 1:1000, should be kept at hand for immediate use.

Moderate or severe reactions characterized by chill and sharp rise in temperature that usually occur within from one-half to one hour after serum injection are not considered anaphylactic. This type of reaction rarely requires more than symptomatic treatment unless the hyperexia becomes excessive.

Intracutaneous test. An area on the inner surface of the forearm is gently cleansed with soap and water, then with alcohol, and 0.1 ml. of a 1:100 dilution of normal horse or rabbit serum in sterile physiologic

salt solution is injected intracutaneously. If a wheal, with or without erythema, does not appear at the site of injection within from fifteen to twenty minutes, the injection of serum is usually a safe procedure. If the skin reaction is positive, serum administration is generally contraindicated unless every facility is at hand to treat a possible severe reaction.

Ophthalmic test. One drop of a 1:10 dilution of serum is dropped into the conjunctival sac. If definite congestion of the conjunctiva develops within from fifteen to twenty minutes with a sensation of itching and burning of the eye, a dangerous sensitiveness to the homologous serum is indicated, and intravenous injection is contraindicated unless "desensitization" is practicable. Should the local reaction be marked, it may readily be controlled by prompt application of epinephrine (1:1000) to the eye.

"Desensitization." The procedure of "desensitization" and the therapeutic administration of serum are not advised in the case of patients with a positive skin or ophthalmic test except under conditions such as may be found in a well-equipped hospital. Serum therapy even under these conditions must be considered hazardous. The following procedure has been used in attempted desensitization. Subcutaneous injections of the serum, beginning with 0.01 ml. or even less, are given at one-half hour intervals until 1 ml. is reached by doubling or tripling the dose if no reaction develops. If 1 ml. injected subcutaneously incites no reaction, 0.1 ml. may be given intravenously one-half hour later. Should this give rise to no reaction, the doses may be increased very gradually until the desired amount has been administered. With a few individuals the limit of tolerance will soon be reached. When an interval of more than three days elapses between injections of serum, the danger of serious reaction is considerable and fatal results even after desensitization have been reported.

Administration of Preparations

In the administration of prophylactic and therapeutic products aseptic technic is essential. Each preparation before being released for distribution is subjected at the laboratory to rigid cultural and animal tests of sterility and harmlessness. Corresponding care should be taken by the physician at the time of injection. The directions given in the circulars accompanying the various products should be followed closely.

Preparations for injection: The skin over the selected area should be thoroughly cleansed with soap and water, then disinfected with alcohol or with tincture of iodine applied to the dry surface. Variations in procedure, when required, are indicated in the circulars accompanying the products.

The syringe should be boiled for at least five minutes immediately before use. A separate, freshly sterilized needle should be taken for each injection.

To remove material from a container through the special rubber stopper, the following procedure should be observed:

Use a sterile syringe on which the needle fits with an air-tight joint.

Wipe off the top of the rubber stopper with disinfectant.

Draw up the plunger of the syringe to the graduation corresponding to the volume to be withdrawn from the bottle.

Insert the needle straight through the center of the stopper so that the tip protrudes a short distance beyond the inner end of the stopper.

Invert the bottle and force air from the syringe into it. Avoid too great pressure.

Keeping the inverted bottle uppermost, release the pressure on the end of the plunger. If necessary, repeat the last two steps until approximately the desired volume of material flows into the syringe.

Holding the plunger firm at the desired graduation, withdraw the needle from the stopper.

Severe or Other Unusual Reactions Following Administration

Severe or other unusual reactions following the use of any of the State products should be reported immediately to the laboratory in Albany, as should any defect in the container, unusual appearance of the material, etc. The information should always include the lot number of the preparation and the return date given on the package.

Reports on the Use of Products

It is of the utmost importance for the maintenance of high standards of production that the laboratory be kept informed as to the efficacy of the preparations distributed. The various laboratory tests used in the standardization of biologic products afford important criteria regarding therapeutic values, but it is to the physician that the laboratory must turn for final proof based upon clinical experience. All the information indicated on the report forms that accompany many of the State preparations is required for the correct evaluation of results. Thus, by filling out the forms completely and returning them promptly, the clinician makes possible for himself and his patients a more efficient laboratory service. The reports on the use of the various products are all of value to the laboratory; many, utilized in publications from the Division of Laboratories and Research, have contributed materially to the progress of vaccine and serum therapy. The collaboration of many physicians in the State has already been obtained and is keenly appreciated; with further realization of the importance of these records the hearty cooperation of all physicians in supplying accurate reports is looked for.

LABORATORY AIDS IN COMMUNICABLE DISEASES

Amebiasis

Experience indicates that in the district served by this Division the incidence of infestations with *Entamoeba histolytica* is low. With the exception of those involved in an outbreak that occurred in the middle west in 1933, most patients found to be harboring these amebae have given a history of having lived in the tropics. A few groups of cases have occurred among the inmates of institutions for the insane and mental defectives.

Specimens for Laboratory Examination

Examinations for evidence of *Ent. histolytica* should be made in a local laboratory. If possible, the patient should be sent to the laboratory for the collection of specimens. The entire stool should be available for study promptly after it has been passed. Oily medication will render the specimen unsatisfactory for examination. The use of a sigmoidoscope and the immediate examination of specimens collected from the base of ulcers may show the presence of *Ent. histolytica* when the protozoa are not found in stool specimens.

A bacteriologic examination of the feces should be made, since in some instances bacilliary incitants of enteric disease will be found, as well as amebae, or the case may be one of bacillary rather than amebic dystentery.

Anthrax

Infections with the anthrax bacillus are usually incurred by handling certain animal products such as hides, hair, or wool, especially those that are imported. Before their manufacture and sale were prohibited in New York State (Sanitary Code, Chap. IX, Reg. 4), shaving brushes containing horsehair represented a particular hazard. Infection usually takes place through the abraded skin and is followed by the formation of a characteristic pustule, but the microorganisms may gain entrance through the alimentary or the respiratory tract. The primary lesion usually occurs within from twelve to twenty-four hours after infection. Diagnosis must be based on the history, clinical manifestations, and the finding of large Gram-positive bacilli in films prepared from the pustule. Readily available laboratory facilities are essential, since the nature of the infection should be determined as soon as possible. For purposes of confirmation, the anthrax bacillus should be isolated and its identity proved by cultural and animal tests. Since the

spores of *B. anthracis* are highly resistant, all contaminated material should either be burned, or boiled in 10-per-cent cresol for one hour.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, the following material should be submitted for examination to a laboratory approved for the purpose: (1) exudate from the lesion on a sterile swab (tube outfit with swab); (2) films of the exudate on glass slides (slide outfit).

If microorganisms having the morphology of *B. anthracis* are found in films from the lesion, a preliminary report can be made at once. Cultural and animal tests, which may be somewhat time-consuming, are required for complete identification of the anthrax bacillus.

Product Supplied by the Laboratory

Antianthrax serum. Serum therapy in human anthrax, or malignant pustule, has proved definitely effective. Prompt administration of the serum is essential. In the early stages excision of the focus of infection is also indicated. A limited supply of a commercial antianthrax serum is maintained at the central laboratory in Albany for emergency distribution. The material can also be obtained through the Branch Laboratory, 339 East 25th Street, New York City. Requests for the serum should be made by telephone or telegraph. If the patient is able to pay for the material or the case is covered by compensation, it is expected that the amount supplied will be replaced promptly. Physicians obtaining the serum are asked to send a complete report to the central laboratory.

Administration. The initial dose of antianthrax serum recommended is from 100 to 200 ml., depending upon the severity of the symptoms, given intravenously or intramuscularly in localized infections. In severe cases of systemic infection an initial dose of 200 ml. given intravenously is advised. Additional doses of 50 ml. at daily intervals may be administered in all cases until there is marked improvement. Detailed directions are given in an enclosed circular.

Botulism

see

Food Poisoning

Chancroid

Ducrey's bacillus, which is believed to be the incitant of chancroid, can be isolated only when the condition of the lesion is favorable, and a specially prepared culture medium can be inoculated promptly after collection of the exudate. Thus, laboratory examinations are usually undertaken only for the purpose of excluding syphilis.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, the specimens specified under "Syphilis" should be submitted to an approved laboratory for examination, in order to detect concurrent syphilitic infection.

Cholera, Asiatic

The inciting microorganism, *Vibrio cholerae,* is found in the feces and vomitus of infected persons, and in the feces of convalescents and carriers. It gains entrance to the body through the mouth and is present in large numbers in the gastrointestinal tract early in the disease. The microorganisms usually begin to decrease between the fourth and the fourteenth day, although they may be excreted for three or four weeks or, occasionally, for as long as from three to four months. During empidemics, they may be found in the feces of healthy persons who have ingested contaminated material.

Federal regulations at ports of entry have been most effective in excluding cholera. Modern methods of transportation, however, may introduce a new hazard from tropical diseases.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, the following material should be submitted for examination to a laboratory approved for the purpose: (1) a specimen of feces in a sterile container without preservative (jar outfit); (2) 10 ml. of blood to be examined for evidence of typhoid fever (typhoid tube outfit). Also, a specimen of feces in 30-per-cent buffered glycerol (typhoid jar outfit) should be submitted to be examined for other bacterial incitants of enteric disease. If possible, the specimens should be delivered to a laboratory by messenger.

The presence of actively motile, Gram-negative, comma-shaped spirilla can be determined promptly by microscopic examination

of specimens of feces. The identification of *V. cholerae* requires data concerning morphologic, cultural, and serologic properties.

Diarrhea

Outbreaks of diarrhea are of frequent occurrence, particularly during the summer and autumn months. Except in cases of acute gastroenteritis incited by microorganisms of the paratyphoid-enteritidis group (Salmonella) or by dysentery bacilli, comparatively little is known regarding the etiology of such outbreaks. They are so explosive in character and of such short duration that investigations are seldom undertaken sufficiently early to yield significant results.

Specimens for Laboratory Examination

Specimens of feces may be submitted (typhoid jar outfit containing 30-per-cent buffered glycerol). They should be supplemented by blood specimens for agglutination tests (typhoid tube outfit) collected at the time the patient is acutely ill and also from two to three weeks after recovery. In addition to the examinations for bacilli inciting enteric disease, a special study of the bacterial flora is made. The submission of blood specimens is desirable so that they will be available, if necessary, for cultural and serologic tests.

Diphtheria

Diphtheria often occurs in epidemic form. The inciting microorganism, *Corynebacterium diphtheriae,* usually becomes localized in the throat, producing characteristic lesions on the mucous membrane of the pharynx, tonsils, or larynx, sometimes extending into the trachea. Similar lesions may occur in the nose and, in rare instances, the conjunctiva, the vagina, and in wounds. The possibility of diphtheritic gangrene should be considered when lesions on the skin fail to heal.

Three classes of individuals may harbor morphologically typical diphtheria bacilli in the throat or nose: (1) those having, or convalescing from, diphtheria; (2) those who, without having contracted the disease themselves, have acquired the microorganisms through contact with others ("contact" carriers); and (3) those who give no history of either having had the disease or having been in contact with patients or carriers ("noncontact" carriers). Diphtheria antitoxin should be given without delay to every patient having clinical diphtheria, whether or not diphtheria bacilli are found, as well as to patients with sore throat when diphtheria bacilli are present.

The period of communicability lasts until virulent bacilli are no longer present in the secretions and lesions. The persistence of *C. diphtheriae* after the clinical symptoms of the disease have subsided is variable. In exceptional instances, virulent diphtheria bacilli remain in the throat or nose for nine weeks or more. The usual length of time, however, is from one to two weeks. In over 90 per cent of all cases, the bacilli disappear after four weeks.

Persons who become persistent carriers of diphtheria bacilli are usually found to have some abnormal condition in the throat or nose, most often diseased tonsils. With few exceptions, however, the diphtheria bacilli disappear in the course of a few weeks without treatment.

If cultures are taken among large groups of apparently normal individuals, as, for example, in a school or institution, approximately 1 per cent will usually show morphologically typical diphtheria bacilli. More than three-fourths of these, however, are found to be avirulent, i.e., incapable of producing toxin. This type of microorganism is generally encountered in the group of so-called "noncontact" carriers. As the carrier condition is often temporary, the diphtheria bacilli being found in only one or two cultures, a request for a virulence test ordinarily should not be made until two or three specimens have been examined to determine whether the microorganisms are persisting.

In the case of convalescent and contact carriers, the fact that diphtheria bacilli have incited the disease is presumptive evidence that they are virulent. Experience has shown that in these instances approximately 95 per cent of the microorganisms remain virulent for three months. In view of this and since the test is expensive and time-consuming, virulence tests upon cultures from convalescents and contact carriers should not usually be requested until three months after the patient has recovered. However, if a health official believes that the circumstances warrant such a request within a shorter time, an explanation should accompany the specimen.

In the preparation of cultures for laboratory examination, the following directions should be observed: only Loeffler's medium that is in a satisfactory condition should be selected; a culture should not be taken immediately after the patient has used an antiseptic as a spray or gargle; the inoculum should be collected at the margin of, or from beneath the membrane rather than from the surface; separate specimens should be submitted from the nose and throat; the medium should be inoculated by rubbing the entire

surface lightly and thoroughly with the swab without breaking the surface of the medium or pushing the swab into it.

A frequent source of annoyance is the contamination of medium with microorganisms which overgrow the culture and make a satisfactory examination impossible. Often, this condition results from the presence of a microorganism in the nose or throat that produces a slimy growth on the culture medium. Irrigation of the nose and throat with warm sterile physiologic salt solution may remove the exudate containing such bacteria.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, a culture from the throat on Loeffler's blood-serum medium, and, if symptoms of rhinitis are observed, a culture from the nose also (diphtheria culture outfit) should be submitted for examination to a laboratory approved for the purpose. When a virulence test is desired, it should be requested on the history form.

> Cultures are incubated at from 35° to 37° C. for from eighteen to twenty-four hours. Morphologic examinations are then made for diphtheria bacilli. When a virulence test is undertaken, the microorganism is obtained in pure culture, its morphology and cultural characters are studied, and its virulence is tested.
>
> When sufficiently large numbers of morphologically typical diphtheria bacilli are present, a suspension of the culture may be tested by the intracutaneous method, thus making an early report possible in case evidence of virulent diphtheria bacilli is demonstrated.

Products Supplied by the Laboratory

In addition to the laboratory aids in diagnosis, there are available to the physician in the control of diphtheria, laboratory preparations for determining susceptibility, for inducing active or passive immunization, and for effecting cure.

Outfits for the intracutaneous test of susceptibility to diphtheria toxin (Schick). The intracutaneous test of susceptibility to diphtheria toxin (Schick) consists of the injection into the skin of 1/50 of the minimum dose of a diphtheria toxin fatal to a guinea pig. When there is insufficient antitoxin in the tissues to neutralize the toxin, a local reddening is induced at the site of injection; when sufficient antitoxin is present, there is no toxic reaction. The test, therefore, is designed to differentiate those who have from those who have not sufficient antitoxin in their blood to render them immune to diphtheria. Reliable results are dependent upon

great accuracy in procedure, and the correct interpretation of the reactions requires considerable experience. A control injection of heated toxin dilution should always be made since some persons react to the protein in the material, especially after immunization.

The percentage of individuals susceptible to diphtheria at different ages varies in different localities and under different conditions. In general, the rural population is more susceptible than that of crowded cities. Adults are less susceptible than children. When practicable, the test should be performed before active or passive immunizaton against diphtheria is undertaken, especially in the case of older children and adults. A retest is necessary after active immunization to determine definitely whether immunity has developed.

In the outfits for the test are two bottles, one containing diluted diphtheria toxin for the test dose, the other containing diluted heated toxin for the control injection. The toxin in each bottle is so diluted wth buffered salt solution that the required amount for the test is contained in 0.1 ml. The toxin in the control dilution has been heated to destroy its toxicity and is used to determine sensitivity to the protein present. The outfits are distributed in two sizes; one in which the bottles contain 5 ml., or sufficient for from twenty-five to forty tests, and the other, 2 ml., or sufficient for about ten tests.

Since unfavorable temperature and exposure to air or light may cause deterioration of the toxin, the contents of individual containers should be used only for tests made at one time. When many tests are to be performed, removal of the stopper and the use of a long, sterile needle (gauge 15, 2 inches) to fill the syringe has been found convenient. Any water remaining in the needle should first be emptied and the syringe and needle rinsed with a small amount of the material for the test. When outfits are requested, the number of persons to be tested should be given, and if the work is to be done in different groups or on different days the number of persons in each group to be tested should also be stated.

The test. One-tenth milliliter of the toxin dilution is injected intracutaneously on the flexor surface of the left forearm and a similar volume of the heated toxin dilution on the right forearm. Special syringe outfits with a separate syringe for the control test can be purchased. Syringes and needles that have been previously employed for tuberculin tests should not be used. A freshly sterilized needle for each child is recommended. When only one reading is practicable, it should be made on the fifth,

sixth, or seventh day after the injection. It has been found convenient to make readings and give the initial immunizing dose to those showing positive reactions, on the seventh day.

Detailed directions accompany each outfit for the intracutaneous test. To secure dependable results it is essential that they be followed closely.

Diphtheria Toxoid

Active immunization. Since the incidence of diphtheria is highest in young children and the mortality greatest in those under five years of age, the active immunization of children of pre-school and school age is an important preventive measure. The immunity usually derived by infants from their mothers is lost during the first months after birth, so that it is desirable that the immunizing injections be given at the age of six months or shortly after. The fact that in children under six years slight, if any, reactions are induced is an added advantage of early administration.

> Since most children are susceptible to diphtheria, the preliminary test of susceptibility (Schick) of those under ten years of age, is often omitted. Fewer adults are susceptible to diphtheria, and more react to the immunizing doses of toxoid; hence, in their case, the preliminary test should always be made to determine the need for immunization. In order to ascertain whether immunity has developed, an intracutaneous test should be made from four to six months after the last immunizing injection. Protection against diphtheria cannot be assumed without a negative test. In the case of children who received toxoid before two years of age, a supplementary dose as an additional stimulus should be given when the child reaches school age or before. A retest to determine susceptibility may first be made.

Diphtheria toxoid, both unprecipitated and precipitated, is prepared, tested, and distributed by the Division of Laboratories and Research for active immunization against diphtheria.

Diphtheria toxoid, unprecipitated, which contains no horse or other serum, is prepared by subjecting potent diphtheria toxin to the action of formalin and heat until the material has become detoxified. The best response appears to be in children between one and six to eight years old. Infants under six months, owing to the temporary immunity usually derived from their mothers, do not respond well to immunization.

Diphtheria toxoid is distributed in bottles containing 5 ml. and in smaller bottles containing sufficient material for the complete immunization of one person or for one immunizing injection of

three persons. When toxoid is requisitioned, the number of children whom it is proposed to immunize should always be stated.

Administration. Injections are given subcutaneously, alternately on the outer side of the upper arm, beginning with the left arm. Three doses of toxoid of 0.5 ml. each at 2- or preferably 3-week intervals are recommended. (Experience indicates that doses even up to 1 ml. may be given to young children without inducing undue reactions.) On account of the small volume, special care should be taken to inject the full amount and to prevent loss by oozing. For persons over 15 years a modified dosage, 0.2, 0.4, and 0.4 ml. at 2- or preferably 3-week intervals, is advised. If the control for the intracutaneous test of susceptibility indicates a high protein sensitivity, the size of the doses may be still further reduced and a fourth dose given.

Diphtheria, toxoid, precipitated, contains no horse or other serum. It is prepared by subjecting potent diphtheria toxin to the action of formalin and heat until it has become detoxified. The active principle is then precipitated by the addition of chemicals and the resulting precipitate washed and resuspended in physiologic salt solution. The presence of the precipitate, which retards absorption, is considered an important factor in the favorable results reported with this purified, stable preparation. Reports on its use in children up to 15 years of age have not indicated a higher incidence of reactions than occurs following the use of unprecipitated toxoid. For older persons a modified dosage of the unprecipitated toxoid is, however, at present recommended.

Precipitated toxoid is distributed in bottles containing 10 ml. and in smaller bottles containing sufficient material for two injections. Requests for the material should always state the number of children to be immunized.

Administration. In order to insure a correct dosage, it is essential that equal amounts of the suspension be injected. The bottle should be thoroughly shaken just before it is opened and rotated each time the syringe is filled. The syringe should be rotated similarly before each injection. One dose of 1 ml. or preferably two doses of 1 ml. each a month apart are recommended. Special care should be taken to insure the injection of the full amount and to prevent loss by oozing. The injection should be made subcutaneously on the outer side of the upper arm, the left for the first and the right for the second if given. Deep or intramuscular injections should be avoided.

Diphtheria Antitoxin

Passive immunization. Protection of contacts not previously shown by the intracutaneous test to be insusceptible to diphtheria may be effected by passive immunization with diphtheria antitoxin. Concentrated diphtheria antitoxin produced by the State laboratory is distributed through supply stations in packages of 1,000 units for prophylactic use. The dose for adults is 1,000 units given subcutaneously; for children, from 500 to 1,000 units, depending upon body weight. Such persons will be protected for a period usually of about two weeks.

Curative treatment. When the lesion in the throat is typical, and especially when in suspected laryngeal diphtheria croupous symptoms develop, antitoxin should be administered immediately and a culture taken for bacterial diagnosis. The harmful effects in diphtheria are due to the diphtheria toxin which diffuses through the body from the local lesion in the throat. Toxin that has become united with the cell substance is probably not affected by antitoxin. When sufficient toxin has combined with the body tissues to cause death, no amount of antitoxin will bring about recovery. Hence, it is of the utmost importance to begin treatment as early as possible in the course of the disease. An early and liberal single injection is always preferable to smaller divided doses. The initial dose should be sufficient but if the clinical symptoms persist the dose must be repeated, possibly increased. The antitoxin for therapeutic use is distributed in packages containing 5,000 and 10,000 units. Directions are contained in each package.

Administration. Immediate curative action is best secured by intravenous injection which is from three to four times as effective as injection into the subcutaneous tissue, but only physicians experienced in intravenous serum administration should practice it. In late or in severe cases, as in emergencies of laryngeal diphtheria, it is much to be preferred. Intramuscular injection, because of more rapid absorption, is more effective than subcutaneous.

Initial Dosage in Diphtheria

Mild	*Moderate*	*Severe to Malignant*
	Children under 60 lbs. in weight	
3,000–5,000	5,000–10,000	10,000–25,000
	Adults	
3,000–5,000	5,000–15,000	20,000–50,000
Intramuscular Subcutaneous	Intramuscular	Intramuscular or Intravenous

(The smaller dose is usually adequate for intravenous injection.)

Intravenous injection is made into the median basilic vein, the antitoxin preferably being diluted with warm sterile physiologic salt solution. In infants, if necessary, the external jugular vein may be used. For precautions against anaphylactic reactions, see page 26.

Dysentery, Bacillary

At least five distinct types of *B. dysenteriae* have been recognized as incitants of bacillary dysentery—Shiga, Schmitz, Sonne, Newcastle, and the mannitol-fermenting group (Flexner and strains having similar properties). Infections with the last four occur not infrequently in New York State, particularly among inmates of institutions, whereas infections with the Shiga type, in which the mortality is relatively high, are extremely rare.

The dysentery bacillus usually enters the body by the mouth, although infection may result from the use of unsterile tubing or other instruments employed in the administration of enemas or in similar procedures.

The microorganism is found in the feces, but seldom if ever in the blood stream or in the urine. When a person has recovered from bacillary dysentery, the incitant can usually be isolated from the stools for only a relatively short time. Occasionally, however, patients develop symptoms of colitis and remain carriers of dysentery bacilli for long periods. The results of serologic tests for evidence of bacillary dysentery have proved disappointing. Blood from many normal individuals has been found to agglutinate dysentery bacilli, while, on the other hand, the titer of serum from patients with dysentery, at least when the specimens are collected early in the course of the disease, may be no higher than that of persons who are not ill. Consequently, blood from patients with symptoms of dysentery is usually examined for evidence of typhoid fever, since the clinical manifestations in these enteric infections may sometimes be similar. Blood specimens from persons who have recently recovered from bacillary dysentery or who develop colitis can be expected to agglutinate the types of dysentery bacilli which incited the infections.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, the following material should be submitted for examination to a laboratory approved for the purpose: (1) a specimen of feces (typhoid jar outfit containing 30-per-cent buffered

glycerol); and (2) 10 ml. of blood to be examined for evidence of typhoid fever (typhoid tube outfit).

The intestinal discharge consisting of blood and mucous as obtained in early stages of the disease, especially when relatively free from fecal matter, is the most suitable for examination.

Note: The value of antidysentery serum for the treatment of infections caused by types other than the Shiga bacillus is questionable. Infections due to this type rarely occur in New York State. In view of these facts and the infrequent requests for the material, the distribution of multivalent antidysentery serum has been discontinued.

Epidemic Encephalitis

The etiology of the most frequently encountered type of epidemic encephalitis has not been determined. In only a few epidemics has the presence of a virus been demonstrated. Laboratory examinations are often of assistance in differentiating this disease from epidemic cerebrospinal meningitis, tuberculous meningitis, or cerebrospinal syphilis.

Specimens for Laboratory Examination

No specific test for encephalitis is at present available. However, the results of a cell count, protein determination, colloidal gold test, quantitative sugar determination, and bacteriologic tests made on specimens of cerebrospinal fluid may be helpful in evaluating the clinical manifestations. Directions for the collection of specimens are given under "Syphilis," p. 70.

Epidemic or Streptococcus (Septic) Sore Throat

see

Streptococcal Infections

Erysipelas

see

Streptococcal Infections

Food Poisoning

The term "food poisoning" is usually employed to designate any illness following the ingestion of food containing certain toxigenic microorganisms or their products.

The most serious, but in this country the least common, form of food poisoning is that known as botulism which results from ingestion of food containing toxin produced by *Clostridium botulinum*. Botulinus toxin is highly poisonous and is not destroyed in the stomach or intestine. Several types of the botulinus bacillus have been recognized, but those most commonly associated with botulism in man are types A and B. Strains of type E have recently been isolated in New York State from canned and also from smoked fish. The products, which had been imported, had not been sterilized by heat. In both instances, individuals who had eaten the fish developed symptoms of botulism; there were two deaths.

The source of infection in North America has, in most instances, proved to be canned vegetables and fruits, while in Europe contaminated ham, sausage, and fish have figured most prominently. Physical evidence of spoilage is usually present in such foods, but fatal cases have resulted from the tasting of food in which signs of decomposition were scarcely noticeable and were unaccompanied by any marked taste or odor. Botulinus toxin is readily destroyed by boiling, but the heating of the food must be sufficient to insure raising every portion to the boiling point.

The symptoms of botulism are: a relatively long incubation period (from twelve hours to several days); gradual onset with visual disturbances, such as double vision, ptosis of lids; difficulty in swallowing; and constipation. The clinical picture closely resembles that following atropin poisoning and bulbar paralysis.

Food poisoning of the more common type has been attributed to toxic products formed by proteolytic microorganisms, such as staphylococci, *B. proteus,* and members of the cloacae-aerogenes group, as well as by species of the paratyphoid-enteritidis group. Illness due to the ingestion of food contaminated by these microorganisms is usually characterized by a short incubation period, sudden onset with abdominal pain, nausea and vomiting, and offensive diarrhea.

Certain foods, especially cooked meat with gravy or cream sauce and custard-filled pastries, offer an excellent medium for the developmnt of this type of bacterium, but determination of the incitant and the source of contamination is often difficult. Bakers and other distributors of cooked foods, as well as the general public, should realize the importance of storage at temperatures unfavorable to bacterial growth. In all instances, the toxic food stuffs are found to have been kept, for a few hours at least, at a temperature that favors the development of bacteria. The source

of *Cl. botulinum* is usually the soil. The staphylococci and other types of bacteria that produce toxic substances in food may be derived from lesions on the hands or from the nose of the food handler, from raw milk from cows with diseased udders, or from the feces of rodents.

Specimens for Laboratory Examination

After an investigation has been made to determine the articles of food consumed by all who are ill, the suspected material should be sent to an approved laboratory, together with the pertinent data, including clinical manifestations of the illness. If canned, a portion of the food taken from the same container or lot as that eaten by the patient should be collected. In the case of botulism, even washings from the can may still contain sufficient material for testing. Since the symptoms in botulism may appear at any time in from twelve hours (rarely less) to several days after the ingestion of the food containing the toxin, any food eaten within that period should be considered.

Specimens of blood and feces from the patients should also be submitted; the blood can be studied for the presence of the toxin and the feces examined for *Cl. botulinum*. (The botulinus spores present in the food eaten probably do not develop in the human body, but may be eliminated in the feces.) For these examinations, about 20 ml. of blood should be sent, a relatively large specimen of feces in a miscellaneous jar outfit without preservative, and another specimen of feces in 30-per-cent buffered glycerol (typhoid jar outfit). The purpose of the examination should be clearly stated on the history form.

Products Supplied by the Laboratory

Botulinus antitoxic sera. Serum therapy in cases of human botulism has not been used sufficiently to warrant a definite statement as to its practical value; that is, how early the serum must be given to be effective or how late in the course of the disease its injection becomes useless. Experiments with animals indicate that the serum may be of value when given within from twenty-four to forty-eight hours after the ingestion of the food containing the toxin. Two types of *Cl. botulinum*, designated as A and B, are most frequently associated with human cases. The toxin produced by strains of one of these types is not neutralized by the antitoxin prepared against that of the other type. Since the immediate

determination of the type is not practicable, a multivalent serum, or both types of univalent sera, A and B, should be given. The two univalent sera may be combined or given separately. The type A serum distributed by the State laboratory is of exceptionally high titer and unconcentrated; the type B serum is concentrated. A specific serum for cases due to type E is not available at present.

Univalent botulinus antitoxic sera of types A and B are produced and distributed in packages containing 20 ml. for immediate use. To facilitate prompt administration, a limited supply of the serum has been placed at certain strategic points in the State to meet emergencies until an additional supply can be secured from the central laboratory. It is available at the supply station in the Branch Laboratory, 339 East 25th Street, New York City, and at those in the departments of health at Buffalo and Rochester, in the Binghamton City Hospital, and in the offices of the district state health officers at Gouverneur and Syracuse. Requests for the serum should be made by telephone or telegraph to the nearest station which at the same time will request an additional supply from the central laboratory in Albany. Information regarding an outbreak, including the number of persons to be treated, should be given.

Administration. A total dose of from 40 to 80 ml. (20 to 40 ml. of each type of serum) should be injected intravenously by gravity at the earliest possible moment. A circular of directions is enclosed in each package.

A prophylactic dose of 10 ml. of antitoxin, multivalent or combined, given intramuscularly, has been recommended for persons who may have consumed some of the suspected food, but have not yet developed symptoms. The appearance of any suggestive symptoms should be followed by the administration of the full dose intravenously. For precautions against anaphylactic reactions, see page 26.

Gas Gangrene

Infection with gas-forming anaerobic microorganisms, designated as gas gangrene, may develop in any dirty, untreated wound, especially when there has been extensive destruction of tissue, as in the case of compound fractures, crushing injuries, and gunshot wounds.

The laboratory can be of little assistance in diagnosis, since the results of examinations are not available soon enough to be of value as a guide in treatment. Therapy to be effective must be undertaken promptly on the basis of clinical and x-ray findings.

Product Supplied by the Laboratory

Gas gangrene antitoxin. Clinical reports received have indicated the value of serum therapy in the treatment of cases of gas gangrene due to the presence in the wound of one or more species of anaerobic bacteria. Treatment should be commenced promptly. A small supply of gas gangrene antitoxin is purchased and held for emergency use at the laboratory in Albany, the Department of Health in Buffalo, the Binghamton City Hospital, and the City of Kingston Laboratory. Requests should be made by telephone or telegraph to the central laboratory, the Branch Laboratory, 339 East 25th Street, New York City, or to the nearest station. The antitoxin, which is multivalent, is produced against the toxins of *Cl. welchii* (*B. perfringens*) and certain other species of pathogenic anaerobes. If the patient is able to pay for the material or the case is covered by compensation, it is expected that the amount supplied will be replaced promptly. The material is not furnished for prophylactic use.

Administration. An initial injection of the contents of one bottle up to that of four bottles is recommended to overcome as far as possible the general toxemia. Subsequent injections of at least the minimum dose (one bottle) may be given at from 4 to 6 hour intervals or longer depending upon the condition of the patient. Intravenous injection is advised until signs of definite improvement are noted; subsequent doses may be given subcutaneously. Detailed directions are contained in each package.

If a prophylactic injection of tetanus antitoxin has not already been given, from 1,500 to 3,000 units should be administered at once and the dose repeated if the wound continues favorable for the development of tetanus infection.

Glanders

Glanders, primarily a disease of horses, can be transmitted to man. The incitant, *B. mallei,* is found in the nasal secretions, pus from nodules, blood, and at times in the urine, saliva, and milk. In man the mode of infection is usually through an abrasion of the skin, but may be through the mucosa of the mouth and nose. A nodule appears at the site of infection, accompanied by lymphangitis and swelling. A general pustular eruption may occur. While the disease is usually acquired from contact with horses, it may be transmitted from man to man.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, the following material should be submitted for

examination to a laboratory approved for the purpose: (1) 10 ml. of blood (typhoid tube outfit); (2) a specimen of discharge on a sterile swab (tube outfit with swab); (3) films of discharge on glass slides (slide outfit).

So few cases of glanders occur in man that little opportunity has been afforded to evaluate the results of serologic tests. Thus, adequate material for cultural examination is desirable.

Glandular Fever and Infectious Mononucleosis

Until the etiology of glandular fever and infectious mononucleosis has been established, their relationship will probably remain unsettled. While the clinical findings and the cytology of the blood may be similar, outbreaks of glandular fever occur among children and may involve a considerable number of individuals, while infectious mononucleosis is characterized by sporadic cases among young adults.

A distinct aid in the diagnosis of infectious mononucleosis is an agglutination test using sheep red blood cells. According to reports in the literature, specimens from patients with glandular fever have rarely been found to agglutinate sheep red blood cells. It might be mentioned incidentally that injections of horse serum, particularly when serum sickness occurs, and administration of bacterial vaccines or other types of foreign protein may give rise to agglutinative properties for these erythrocytes.

Specimens for Laboratory Examination

Blood films (slide outfit) may be submitted for differential leucocyte counts and 10 ml. of blood (typhoid tube outfit), for serologic tests.

Gonorrhea

Laboratory aids in the diagnosis of gonorrhea have proved especially helpful. The inciting microorganism, *Neisseria gonorrhoeae*, is usually found in large numbers in the primary lesions and, if the work can be done in a nearby laboratory, the gonococcus can usually be isolated. When complications develop, the results of cultural tests may be particularly useful. The results of serologic tests may be helpful or may be misleading; they should be interpreted only in the light of the clinical diagnosis or in conjunction with the morphologic or cultural demonstration of the presence of the gonococcus in the disease process. Serologic methods are under investigation in order to determine more definitely the practical value of these tests.

Infectious Mononucleosis

see

Glandular Fever and Infectious Mononucleosis

Influenza

The demonstration of the virus of influenza is not applicable as an aid in diagnosis. Since patients with influenza seem particularly susceptible to pneumonia, the examination of sputum for pneumococci and cultural tests of the blood are desirable if symptoms of pneumonia develop. Leucocyte counts may be helpful, also, since uncomplicated influenza is characterized by leucopenia, while a leucocytosis is expected in case the patient develops a pneumonia incited by a pneumococcus.

Jaundice, Acute Infectious

Severe types of acute infectious jaundice incited by *Leptospira icterohaemorrhagiae* and *Leptospira canicola* are endemic in certain parts of Japan and Europe, and sporadic cases have been reported in this country. Rats and dogs are carriers of the leptospirae; the microorganisms are present in the kidneys and excreted in the urine. Infection of human beings apparently results from contact with the urine of infected animals. The rare occurrence of cases of leptospiral jaundice, in spite of the wide distribution of the inciting agent, has been attributed to the fact that the microorganism is extremely sensitive to drying and sunlight. It probably survives but a short time after being excreted from the animals.

Cases of acute jaundice, apparently infectious, that have occurred sporadically and in localized outbreaks have been studied by a number of observers, but in only a few instances was evidence obtained that the leptospira was the incitant. Investigations are being continued as opportunities occur.

Specimens for Laboratory Examination

Specimens of blood (tube outfit—swab or needle removed) and urine (jar outfit) may be submitted for examination. These should be collected aseptically and the purpose of the examination indicated upon the history form.

Malaria

Occasional cases of malaria occur in New York State. The anopheline mosquito, which is the intermediate host, is found in various parts of the State and since human carriers harboring the plasmodia may be living or traveling in the State, opportunities are probably not lacking for transmission of the infection. Blood films to be examined for malarial parasites should be prepared before the administration of quinine.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, films of blood, on glass slides (slide outfit), preferably taken just before the expected chill, should be submitted for examination to a laboratory approved for the purpose.

Measles

The incitant of measles has not been definitely determined, although evidence has been obtained that a virus is involved. Laboratory aids in diagnosis are therefore not available. However, should the patient develop symptoms of pneumonia, the examination of specimens described under "Pneumonia," p. 52 is desirable.

Products Supplied by the Laboratory

Sodium citrate solution for use in the collection of parent's blood. Published reports and those which have been received by the State indicate that when a prophylactic injection of whole blood taken from an adult with a history of measles is given to children within from four to possibly six days of exposure to measles, an attack may usually be modified or prevented. A modified attack of measles induces an active immunity. Adult whole blood is used for preventive treatment of contact children between three months and five years of age, the period in which most of the deaths from measles occur. It may also be given in the case of older children whose physical condition is such that an unfavorable prognosis would be anticipated should measles develop.

Sterile sodium citrate solution for use in the collection of parent's blood for the modification or prevention of measles is distributed through the local supply stations. Each package contains sufficient solution for one preventive treatment, a circular giving detailed directions, and a report form.

The blood from one of the child's parents who has had measles should be used unless contraindicated. Blood grouping is unnecessary. Only persons in good physical condition and free from symptoms of tuberculosis, syphilis, malaria, or any other communicable disease should be selected. The blood is taken from one of the veins at the elbow into a syringe into which the sodium citrate solution has previously been drawn. Aseptic precautions should be observed throughout the procedure.

Administration. The citrated blood is injected slowly into the muscles of the lateral aspect of the thigh, into the upper outer quadrant of the buttocks, or between the scapulae. It may be injected in two areas. The dose for children under five years of age is from 20 to 30 ml. of blood. In case the blood is given to children over five years of age double the amount has been advised.

Physicians are urged to fill out and return after three weeks the report form contained in each package of sodium citrate solution to the central laboratory in Albany.

Globulin solution (human). Owing to the difficulty in securing suitable donors, the distribution of convalescent measles serum for the modification or prevention of measles has been discontinued. Globulin solution (human) prepared by the extraction of placentas with sodium chloride solution and subsequent precipitation and dialysis of the globulin fraction has been substituted. Results of clinical trial of globulin solution indicate that its prophylactic activity compares favorably with that of convalescent serum.

Globulin solution prepared for distribution in bottles containing 5 ml. may be obtained by direct application to the central laboratory for use in contact children under four years of age and in those in institutions when indicated.

Administration. Injections should be made into the muscles of the lateral aspect of the thigh, into the upper outer quadrant of the buttocks, or between the scapulae. A dose of from 2.5 to 5 ml. is at present recommended, depending to some extent upon the age of the child and the length of the period since exposure.

In order to secure data on the value of globulin solution, it is essential that reports be received on all cases in which it is used. A report form is enclosed in each package. It should be returned after three weeks to the Division of Laboratories and Research, Albany.

Meningococcus Meningitis

While many species of pathogenic bacteria have been reported as the occasional incitants of meningitis, in cases of purulent

meningitis that do not follow an infectious process in the mastoid or elsewhere, the meningococcus (*Neisseria meningitidis*) is the microorganism most frequently encountered. Consequently, when the cerebrospinal fluid is cloudy, not as the result of a bloody tap, sero- and/or chemo-therapy should be commenced promptly. Therapy should not be delayed pending the results of laboratory examinations unless they can be performed immediately in a nearby laboratory. As meningococci autolyze readily, few may be found in the cerebrospinal fluid, and in some instances, when the examination cannot be made promptly, none can be demonstrated. Experience has indicated that when large numbers of polymorphonuclear leucocytes are present in the cerebrospinal fluid and no bacteria are found, the incitant is usually the meningococcus which is often found in a later specimen from the patient.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, a specimen of cerebrospinal fluid in a sterile container (tube outfit—swab or needle removed) should be submitted for examination to a laboratory approved for the purpose. Directions for the collection of specimens are given under "Syphilis," p. 70.

Product Supplied by the Laboratory

Antimeningococcus serum. Multivalent antimeningococcus serum is available for the treatment of meningococcal meningitis. While the serum is of practical value only in cases of meningococcal meningitis, it may not be harmful when the disease is incited by other microorganisms. Thus, if on lumbar puncture cloudly cerebrospinal fluid is obtained, indicating an infectious process, the first dose of serum may be given at once. Further serum treatment should depend upon the results of the bacteriologic examination of the cerebrospinal fluid.

Chemotherapy with sulfanilamide and related compounds has been shown to be definitely effective in the treatment of meningococcal meningitis. It should be used to complement serum therapy in the treatment of all persons who can tolerate the drug. On the basis of experimental studies, combined sero- and chemotherapy appears to be more effective than either agent alone.

Multivalent antimeningococcus serum is prepared by the Division of Laboratories and Research and distributed in bottles containing 20 ml. on special request through the district laboratory supply sta-

tions. As only a small supply is maintained at a local station, when serum is requested for a case the station is expected to telegraph immediately to the central laboratory for additional material so that an ample supply will be available for further treatment.

Since the serum is multivalent, differentiation of meningococcus groups or types is not essential when morphologic and cultural examinations have shown the presence of the meningococcus. It may, however, be of great importance from the standpoint of effective serum production to obtain data concerning the incidence of groups and especially the classification of strains from cases in which response to serum treatment has been slight or absent. The local laboratory should be requested to send the meningococcus strain isolated to the central laboratory in Albany for further study or, if local facilities are lacking, the cerebrospinal fluid should be sent directly.

Administration. The serum should always be given intraspinously since the site of the infection is in the meninges. The amount of serum introduced should be somewhat less than the quantity of cerebrospinal fluid withdrawn. In adults, from 20 to 40 ml. may be given; in children, up to 20 ml. or more depending in both instances upon the amount of fluid withdrawn and the ease with which the serum runs in by gravity. In moderate or mild cases, injections of the serum at 24-hour intervals are usually adequate. The injections should be repeated each day for the first four to six days. Further administration depends upon the patient's general condition and the bacteriologic examination of the spinal fluid. Injections should, in general, be continued until at least two successive specimens of cerebrospinal fluid are free from microorganisms. Intraspinous administration of serum for too long a period may give rise to symptoms that suggest recurrent meningitis. Overtreatment should, therefore, be avoided. In severe cases the serum should be injected every six or twelve hours for three or four doses and thereafter every twenty-four hours. In prolonged subacute or chronic cases, the administration must be continued. If a period of more than three days elapses between injections, the danger of severe anaphylactic shock should be borne in mind.

One or two intravenous injections of the serum—of about 20 ml. each—during the early stage of meningococcal meningitis, which has been recommended on account of the presence of meningococci in the blood, may be of value in supplementing the intraspinous treatment but should not be substituted for it. To lessen the possibility of anaphylactic reactions, the intravenous dose should follow rather than precede intraspinous injection of the serum. It is

only the exceptional case or a meningococcemia without cerebrospinal involvement that requires repeated intravenous injections or increased dosage.

Intraventricular and intracisternal injections of the serum are required in the complicated cases with blockage of the canal and should be undertaken only by physicians skilled in the use of these methods.

Some of the published reports recommend an excessive dosage which appears not only to be unnecessary, if sera of high potency and broad valency are used, but possibly even harmful, especially if continued for any length of time.

A circular giving detailed directions for the administration of the serum is enclosed in each package. For precautions against anaphylactic reactions, see page 26.

Ophthalmia Neonatorum

The majority of cases of ophthalmia neonatorum, especially the severe ones, owe their origin to the gonococcus. Proper treatment of such infections must be begun promptly if the sight is to be saved. Unless laboratory service is available in the locality so that specimens can be examined immediately, the laboratory findings are of value only for purposes of confirmation of the clinical diagnosis.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, films of the exudate from the eye on glass slides (gonorrhea slide outfit) should be submitted for examination to a laboratory approved for the purpose. A microscopic examination only can be made when the specimen must be submitted by mail. If local laboratory service is available, cultural tests often prove helpful.

Product Supplied by the Laboratory

Silver nitrate solution. The immediate application into the eyes of new-born infants of a 1-per-cent silver nitrate solution, or other agent equally effective in preventing ophthalmia neonatorum, is required by the Sanitary Code. The central laboratory distributes the silver nitrate solution to physicians through district supply stations and their substations in outfits containing two wax ampoules. Each ampoule has sufficient material for the treatment of one baby. Full directions for use accompany each outfit.

Plague

Plague is primarily a disease of rodents, the incitant of which, *Pasteurella pestis,* is transmitted, except in the pneumonic form, by fleas and probably other blood-sucking insects. The microorganism is harbored chiefly by the rat, but ground squirrels and other rodents have also been shown to be the source of the infection. Plague has been proved to be endemic in wild rodents in some districts in California, and infected animals are occasionally reported in other western states. Thus, the possibility of the occurrence of the disease in New York State must be kept in mind. While suggestive findings may be obtained by morphologic examination of exudate from a bubo, the results of bacteriologic and animal tests are necessary to identify *Past. pestis.*

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, the following material should be submitted for examination to a laboratory approved for the purpose: (1) a specimen of discharge or aspirated fluid, if a bubo is present (tube outfit with swab); (2) 10 ml. of blood (typhoid tube outfit); (3) in the pneumonic type of plague, a specimen of sputum (jar outfit). If possible, the specimens should be delivered to a laboratory by messenger.

Pneumonia

In pneumonia, the laboratory findings are of the greatest importance in diagnosis and treatment. While a small percentage of infections are induced by other incitants, the vast majority are incited by pneumococci. The classification of these microorganisms into serologic types forms the basis for rational serum therapy, which, to be effective, must be undertaken early. Thus, determination of the type of pneumococcus in the sputum as promptly as possible is of primary importance. The Neufeld technic for pneumococcus-type differentiation permits the results to be available usually within a half hour after the specimen has been received. If a specific type is not found by this means, further bacteriologic examinations to identify the probable incitant may require a day or more.

The physician should explain to the patient that sputum from the air passages in the lung obtained by coughing is necessary for laboratory examination since saliva or post-nasal discharge is usu-

ally valueless. Strapping of the chest to reduce pain occasioned by coughing may be helpful in the collection of sputum. Since young children usually swallow sputum, specimens of the stomach contents may be found to contain the incitant of the pulmonary infection. Also, if a child can be induced to cough, a small amount of sputum can sometimes be collected from the throat on a sterile swab. It should be borne in mind, however, that a large number of persons carry pneumococci of various types in the nose or throat. Consequently, in the collection of specimens from children, it is important to secure sputum rather than exudate from the nasopharynx.

In addition to the study of sputum, cultural examination of the blood is helpful in diagnosis and prognosis and is recommended in all cases of pneumonia. The findings may be particularly useful when more than one type of pneumococcus has been found in the sputum. If the patient is being treated in the home, the blood can be collected in a sterile tube containing a suitable anticoagulant and delivered to the laboratory with the specimen of sputum. If a pneumococcemia is present, the type of pneumococcus can usually be identified the day following the receipt of the blood specimen. The initial sputum specimen and blood culture should be obtained before sero- or chemo-therapy is begun, since it is often difficult to determine the causative microorganism after such treatment has been instituted.

A leucocyte count is important in pneumonia. The percentage of polymorphonuclear elements and the relative number of those which are immature should be determined.

So-called bronchopneumonia and pneumonia complicating other infectious diseases, particularly influenza and measles, and postoperative pneumonia may be incited by pneumococci and, therefore, pneumococcus-type differentiation should be performed.

Products Supplied by the Laboratory

Antipneumococcus sera. Striking results have followed early treatment of cases of pneumonia due to a number of different types, particularly types I, II, V, VII, and VIII in adults and type XIV in infants, with the corresponding antipneumococcus sera.

Prompt diagnosis, early administration of serum, and adequate dosage are essential in the serum therapy of pneumonia. Since serum cannot be expected to be effective except against the homologous type of inciting pneumococcus, it should not be administered

until the type has been determined. Serum therapy initiated late in the course of the disease is less effective and may actually be harmful in patients with cardiovascular disease. The period of convalescence should not be shortened in cases recovering promptly under serum treatment.

Sulfapyridine (and more recently sulfathiazol) has been shown to be highly effective in the treatment of pneumonia. However, recent experimental and clinical evidence indicates that a combination of serum and drug may be the therapy of choice. Unless contraindicated, in cases that fail to respond within from twelve to eighteen hours chemotherapy should be supplemented by serum therapy; also, in persons over fifty years of age; in patients first seen after the third day of the disease; in pregnancy; in cases with involvement of multiple lobes; and in those known to be bacteriemic.

Antipneumococcus horse and rabbit sera produced against a number of the pneumococcus types are distributed by the Division of Laboratories and Research. The horse sera are concentrated and purified. A small bottle containing normal horse or rabbit serum diluted 1:10 with salt solution for use in the tests of sensitivity to the serum is included in each package of antipneumococcus serum. Sterile physiologic salt solution in 10-ml. amounts may be obtained for use in preparing the dilution for the intracutaneous test of susceptibility, for rinsing water from syringes and needles that have been boiled, and for diluting the serum for the preliminary injection.

At present antipneumococcus horse sera of types I, IV, and V, and rabbit sera of types II, VII, VIII, and XIV are distributed through regularly established laboratory supply stations. The location of the stations designated to distribute the sera and the various types available may be ascertained from the district state health officers or the Division of Laboratories and Research, Albany. Antipneumococcus rabbit sera of the remaining types are supplied on request for the treatment of all suitable cases and for those of pneumococcal meningitis from the central laboratory, and from the Branch Laboratory, 339 East 25th Street, New York City. When serum is obtained, physicians are required to fill in completely and sign a request form with pertinent data regarding the patient and stating that bacteriologic examination in the laboratory designated has established the presence of micro organisms that correspond to the type of serum requested. This information facilitates contacts between the physician and the laboratory and other cooperating agencies and promotes complete and accurate reporting of cases.

Administration. To be effective the serum must be given intravenously. Full directions concerning precautions against anaphylactic reactions will be found on page 26. These directions and the technic of administration of the serum are also given in the circular that accompanies each bottle. Caution should be observed to avoid overheating of the serum in preparing it for injection.

A preliminary injection of 1 ml. of the therapeutic serum should be followed in one hour by the remainder of the first dose, the contents of two vials. A second dose is usually given approximately four hours after the first. For type-I cases, the contents of four vials (100,000 units) and for type-II cases about twice that number is recommended for the treatment of the average case. The contents of from four to six vials is suggested for the other types. At least double the dosage may be required in cases of over seventy-two hours' duration, in those failing to show improvement within twelve hours, and in those with a positive blood culture. Favorable clinical response is the most reliable index of adequate dosage. If chemotherapy is used in combination with serum therapy, smaller total amounts of both drug and serum may be required than are necessary when either is used alone.

Poliomyelitis, Acute Anterior

The incitant of acute anterior poliomyelitis, an ultra-microscopic virus, is believed to be present usually in the nasal and buccal discharges of infected persons, and, at times, in the feces. Monkeys have developed the disease following the introduction into their nasal cavities of material from the nose and mouth of human patients and after intraperitoneal inoculation of extracts of feces.

During the preparalytic stage, the physician must depend upon clinical observation for his diagnosis. The findings in the examination of cerebrospinal fluid may be helpful. For these to be of greatest value, the specimen should be examined in a nearby laboratory, promptly after collection.

Specimens for Laboratory Examination

No specific test for acute anterior poliomyelitis is at present available. However, the results of a cell count, protein determination, colloidal gold test, quantitative sugar determination, and bacteriologic tests on specimens of cerebrospinal fluid may be helpful in evaluating the clinical manifestations. Directions for the collection of specimens are given under "Syphilis," p. 70.

Psittacosis

The virus of psittacosis is usually acquired through contact with diseased birds, although nurses have occasionally developed the disease while caring for patients. Since the outbreak in 1929-30, few cases of psittacosis have been reported in New York State. Legislation has been enacted (Sanitary Code, Chap. II, Reg. 38) which prohibits the importation, breeding, sale, or offer of sale of birds of the psittacine family, with the exception that the importation and breeding of such birds for scientific research or exhibition in public zoological gardens may be permitted subject to the approval of the State Commissioner of Health.

Results of laboratory examinations are of little value in furnishing information that can be used in recommending treatment for patients with psittacosis. Demonstration of the virus in sputum or blood requires inoculation of mice, and the findings may not be available for a week or more. Specimens of sputum have been found the most useful for this purpose.

When the examination of birds is desirable, if they are still alive, they should be chloroformed, wrapped in cloth or absorbent cotton saturated with 5-per-cent lysol, and shipped to the laboratory by express in a water-tight container. Cracked ice or dry ice should be used to prevent decomposition. Birds with psittacosis, if shipped alive, would endanger persons who might come in contact with them during transit.

Rabies

Rabies is an acute and rapidly fatal infection of mammals, particularly dogs. The incitant, a virus, is present in the saliva of animals suffering from the disease, and may be conveyed to man through the broken or abraded skin, most frequently by bites of dogs. The period of communicability for man is not known, but for the dog it may be as early as four days before the onset of clinical symptoms and throughout the clinical course of the disease. The incubation period in man is usually from six to nine weeks, but it has been known to be as short as twelve days. In dogs, the period of incubation is usually fourteen days or less. Since, however, this period is sometimes prolonged, an animal that has been bitten should be killed or held in quarantine for at least six months. An animal which is apparently normal but which has bitten a person should not be killed, but kept under competent observation for one week. If it shows clinical symptoms of rabies, it should be

killed at once and the head submitted for laboratory examination (Sanitary Code, Chap. II, Reg. 10).

Since Negri bodies can usually be demonstrated microscopically in the dog's brain but very little earlier than the appearance of clinical manifestations, it is best not to kill the animal before such symptoms are evident. When Negri bodies are not demonstrated, the microscopic examination must be confirmed by animal inoculation, which usually requires from two to nine weeks for completion.

Specimens for Laboratory Examination

Whenever any animal that has or is suspected of having rabies dies or is killed, it is the duty of the health officer to cause the head of the animal to be removed and sent immediately, properly packed, with complete pertinent data, to a laboratory approved for this purpose (Sanitary Code, Chap. II, Reg. 10). Great care should be taken to avoid infection from the dog's saliva, which may fleck its entire body.

A most important factor in the examination of the brain is the arrival of the specimen at the laboratory in a satisfactory condition. Decomposition renders the results of the examination, in most cases, unsatisfactory. The head should be submitted to the most accessible laboratory approved for the examination. Information in regard to the location of these laboratories is furnished to health officers and other physicians annually. The specimen should be kept cold, and, whenever possible, should be delivered by messenger. If messenger service is not available, the head should be placed in a container that closes tightly. This in turn should be put in a water-tight container and packed with cracked ice. The use of dry ice is not recommended, since freezing of the brain, which usually occurs, delays the examination and may affect the condition of the tissue.

Record of the clinical symptoms shown by the animal and information as to whether persons or other animals have been bitten should accompany the specimen.

> It is important to avoid trauma to the brain tissue of animals to be examined for evidence of rabies. Strychnine or other chemical poisons that may interfere with the results of animal-inoculation tests should not be used. The animals should preferably be killed by gas or by a shot through the heart.

Product Supplied by the Laboratory

Rabies vaccine. Rabies vaccine is given for preventive purposes only. No effective therapeutic treatment is available. The prompt use of the vaccine is indicated in the case of all persons bitten by an animal with clinical or suspicious symptoms of rabies, of persons bitten by a stray animal that cannot be found, and in all instances in which the laboratory examination of the brain has shown the animal to have been rabid.

Cauterization. Wounds caused by rabid animals should be immediately and thoroughly cauterized by a physician with fuming or concentrated nitric acid. In districts where rabies is present all wounds caused by animal bites should be cauterized. Laboratory experiments in this country have indicated that cauterization by heat is less effective than by nitric acid and that carbolic acid, iodine, etc., are much inferior. Nitric acid should be applied very carefully to all parts of the wound and edges of the skin; for this purpose a glass rod is convenient.

Antirabic vaccine (Semple method), prepared commercially, is available to physicians in the State outside of New York City. Applications by telephone or telegraph should be made to the Branch Laboratory, 339 East 25th Street, New York City. The name and age of the patient and the location of the bite should be given. If the patient is unable to pay for the material, it is expected that the local boards of health in a position to defray the expense will do so. Otherwise, the vaccine will be furnished by the State.

Sufficient vaccine for a course of fourteen daily injections is sent at one time. Immediately upon receipt the material should be placed in the cold. Each dose is of equal strength and contained in 2 ml. Children receive the same dosage as adults. In the case of extensive bites and those on the head or neck, especially when the wound has not been thoroughly cauterized with strong nitric acid, or when treatment has been delayed, a course of twenty-one doses is suggested. The treatment should not be undertaken by health officers or other physicians who are not familiar with it. The district state health officer should be consulted in any emergency, but if questions arise during the treatment it is advisable to communicate with the branch laboratory. Physicians who obtain the vaccine treatments from the State are expected upon completion of the treatment to fill out and return promptly to the branch laboratory the report form on the use of the vaccine, which is forwarded to them ten days after the material.

Administration. The injections are distributed in the subcutaneous tissue of the abdominal wall and the interscapular region. Since the virus is easily affected by temperature conditions and certain disinfectants, special care should be taken to follow the directions enclosed in each package. Some local soreness, together with erythema at the site of injection, may occur. Notice of other unusual symptoms, especially those of neuritis, should be sent promptly to the branch laboratory.

Rat-Bite Fever

Rat-bite fever (Sodoku) is an infectious disease believed to be incited usually by *Spirillum minus,* communicated to man by the bite of a rat or, more rarely, the bite of some animal preying upon rats, as the cat, the dog, the ferret, or the weasel. After a period of incubation, local inflammation occurs at the site of the bite. Repeated paroxysms of fever usually occur, accompanied by erythema, especially about the joints proximal to the bitten part. If a diagnosis is not made and appropriate treatment given, the disease may become chronic. A form of rat-bite fever is also incited by *Streptothrix muris-ratti.*

Specimens for Laboratory Examination

The incitants of rat-bite fever remain viable for only a very short time outside the animal organism. Arrangements should be made to inoculate mice, rats, or guinea pigs with specimens of blood promptly after they have been collected. Serum expressed from the margin of the wound or from a skin macule, or fluid aspirated from the regional lymph node may also be examined.

Blood from the inoculated animals is examined for spirochetes by dark-field illumination daily from the eighth to the fifteenth day after inocluation. Cultural examination is also made for *Streptothrix muris-ratti* in case the animals die.

Rocky Mountain Spotted Fever

see

Typhus Fever and Rocky Mountain Spotted Fever

Scarlet Fever

see

Streptococcal Infections

Septic Sore Throat

see

Streptococcal Infections

Smallpox

The incitant in smallpox is a virus which passes with difficulty through a Berkefeld filter and, according to certain observers, loses some of its activity as a result of such filtration.

Specimens for Laboratory Examination

The contents of a pustule can be used for the inoculation of rabbits when diagnosis on the basis of clinical findings is questionable. The results will not be available, however, for more than four days.

Vaccination against Smallpox

State regulations relating to vaccination against smallpox—as to approved methods of vaccination, reportability, care of cases, and the principal points of differential diagnosis between this disease and chicken pox—are set forth in the Sanitary Code, the Public Health Law, the Administrative Rules and Regulations of the State Commissioner of Health, and in pamphlets distributed by the State Department of Health.

Smallpox vaccine is not prepared by the Division of Laboratories and Research for distribution. Since a reliable product at a relatively small cost may be obtained from commercial laboratories, the vaccine, when required, is purchased by the local boards of health. The activity of the vaccine is materially affected by unfavorable storage conditions, and, undoubtedly, a majority of unsuccessful vaccinations might be traced to this source. In no instance should vaccine that has been stored at room temperature be accepted. State regulations prescribe that vaccine virus be kept at 40°F. or lower. The optimum temperature is about 10° below the freezing point.

A proper interpretation of the reaction following vaccination is essential. Vaccination properly performed with fresh, fully potent virus, will result in one of three types of reactions: (1) typical primary vaccination, the usual course in an unvaccinated individual; (2) vaccinoid reaction, occurring in previously vaccinated

persons, in which the broadest redness is reached in from three to seven days; (3) the so-called reaction of immunity, indicating full protection against smallpox, which reaches its maximum in from eight to seventy-two hours after vaccination. With vaccine that has lost any of its potency, however, varying reactions which may be confused with reactions of immunity occur, so that the proper interpretation can be made only by physicians thoroughly familiar with the several types of reactions, and when full potency of the virus used is definitely proved. A fully potent vaccine may be defined as one that gives one hundred per cent "takes" in previously unvaccinated individuals.

Snake Bite

The presence of rattlesnakes and copperheads in certain districts of New York State has, with the increase of camping and outdoor travel, become a matter of considerable popular interest and concern. While relatively few cases of snake bite are reported and fatalities in this part of the country have been very rare, health officers and physicians should become familiar with the methods of treatment and the facilities now available.

Product Supplied by the Laboratory

Anti-snake-bite serum. A multivalent antitoxic serum is produced in horses against the venoms of the copperhead, water moccasin, and rattlesnake, three of the most poisonous snakes of North America. A limited supply of a commercial concentrated product is maintained at the Bear Mountain Headquarters of the Palisades Interstate Park, in the department of health at Copake, and at the district laboratory supply stations in Glens Falls, Port Jervis, and Nyack. The serum is distributed for emergency use in the treatment of actual cases of snake bite, not for stock. If the patient is able to pay for the material or it is a case covered by compensation, it is expected that the amount supplied will be replaced promptly. Physicians obtaining the serum are asked to send a complete report to the central laboratory in Albany.

In cases of snake bite the following procedure has been recommended: (a) the immediate application of a ligature or tourniquet above the bite, which is usually on the leg or arm, applied at first just tightly enough to prevent absorption and not interfere entirely with the flow of blood; (b) avoidance of exertion; (c) avoidance of all alcoholic or other stimulants. The tourniquet

is released when serum has been given. Incision and suction are advisable to withdraw as much venom as possible, especially if treatment with serum is delayed. A dressing of a strong solution of table salt or Epsom salt in water may be used. Cauterization or the use of potassium permanganate is not advised. Detailed directions for the use of the serum are contained in each package.

Administration. The amount of serum in one package (10 ml.) is stated to be usually sufficient to protect an adult against the amount of venom injected by the bite of a moderate sized snake. In the case of children, however, double this amount is advised for the initial dose. Injections are given preferably intramuscularly but may also be given subcutaneously. Intramuscular injection ensures more rapid absorption than subcutaneous. In late cases or in those in which puncture of a blood vessel at the time of the injury is suspected, the intravenous method is much to be preferred. It is highly important that the serum be given as early as possible. Under certain conditions, repeated injections at short intervals are recommended.

Streptococcal Infections

Hemolytic streptococci are associated with a variety of infections, including scarlet fever, erysipelas, septic sore throat, and puerperal sepsis. Although it is impossible by laboratory procedures to establish a definite etiologic relationship between a specific streptococcus and any of these conditions, the majority of cultures isolated from lesions in man belong to a single serologic group. Thus, the group-precipitation test is especially useful in the study of hemolytic streptococci isolated from cows when outbreaks of streptococcal infection occur among consumers of raw milk from a particular dairy. Experience is indicating that when hemolytic streptococci belonging to the group commonly encountered in human infections are isolated from milk, one of the milkers has a history of recent acute infection, such as sore throat, scarlet fever, or a lesion on his hand. Veterinary examination of the cows usually indicates that one or more has mastitis incited by streptococci from such a lesion. Occasionally the evidence points to the fact that the raw milk has been contaminated directly by pus from the human source.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code with respect to epidemic or streptococcus (septic)

sore throat, a culture from the throat on Loeffler's blood-serum medium, and the swab used in making the culture (diphtheria culture outfit) should be submitted for examination to a laboratory approved for the purpose. The diagnosis should be clearly indicated on the history form, as well as the fact that an examination for hemolytic streptococci is desired.

Investigation of outbreaks of scarlet fever or septic sore throat among users of unpasteurized milk from a common source should include a study of cultures collected from lesions on the hands and from the noses and throats of all persons coming in contact with the cattle or the milk, and the examination of samples of milk collected from the individual quarters from any animals in the herd that show evidence of mastitis or have lesions on the udders or teats. Samples of milk may be satisfactorily preserved for this type of examination by combining two parts of milk with one part of glycerol of tested purity.

Products Supplied by the Laboratory

Antistreptococcus serum. *Scarlet fever, erysipelas, etc.* A streptococcus specific to scarlet fever has not been differentiated. If the streptococcus is the primary and not the secondary incitant, scarlet fever should not be considered a specific disease—simply one manifestation of streptococcal infection. The results of study in this country and abroad have not only modified premature conclusions but have also provided a sound basis for investigation of the practical value and limitations of serum therapy in streptococcal infection. Since it is not possible by present methods to distinguish a specific streptococcus associated with scarlet fever or any other form of streptococcal infection, serum therapy of all streptococcal infections is a rational procedure, the limitations of which should be determined. The serum supplied by the State laboratory is produced by the immunization of horses with representative strains of streptococcus in order to obtain a product of the highest potency and broadest valency practicable. The serum is distributed for therapeutic use in packages containing 5,000 units. A circular giving detailed directions for the administration of the serum is enclosed in each package.

Antistreptococcus serum has been and still is used in the treatment of scarlet fever. It is of definite practical value, often completely overcoming the toxemia. Mild cases may not require treatment, but it is not always possible to distinguish the mild case in

advance. Complicated cases, in which the streptococci have become generalized, do not always respond strikingly to treatment. The prompt use of the serum in order to prevent complications is of the utmost importance.

The treatment of erysipelas with antistreptococcus serum has also been considered effective in a considerable number of cases. According to laboratory tests and clinical reports, the results obtained from the administration of the antistreptococcus serum distributed by the State laboratory are comparable to those obtained with special sera produced elsewhere for the treatment of erysipelas only. Reports have also been received of the effectiveness of the serum in acute hemolytic streptococcal infections other than scarlet fever or erysipelas.

The value of sulfanilamide in the treatment of scarlet fever has not been established but it has proved to be an effective agent in certain other hemolytic streptococcal infections. There is no conclusive evidence that sulfanilamide neutralizes the toxic products of streptococcal growth. It does, however, restrict the growth of the microorganisms and thus limits the amount of toxic material liberated. Hence, even though chemotherapy is instituted early and continued, it does not take the place of serum in the treatment of the toxemia.

Passive immunization—the treatment of contacts with antistreptococcus serum (horse)—is not recommended owing to the temporary nature of the immunity induced, the severe reactions that may occur, and the possibility of inducing hypersensitivity to later injections of horse serum. Careful supervision of contacts and early administration of a therapeutic dose of serum, should symptoms develop, is advised. Serum for prophylactic use is not distributed by the State laboratory.

Administration. Early administration of the serum and adequate dosage are essential in all forms of streptococcal infection. Occasionally cases fail to respond even to intensive treatment. The first dose should be at least 10,000 units on account of the difficulty of determining the severity of the infection at an early stage. In extremely toxic cases or those in which complications have developed, it may be necessary to continue the treatment by repeated doses of 10,000 or 20,000 units at intervals of twelve or twenty-four hours, depending upon the condition of the patient. For very young children the doses may be somewhat reduced.

In scarlet fever usually one dose, if sufficiently large, suffices. Satisfactory results are reported with intramuscular injection, but

in severe cases it may be preferable to give part or all of the dose intravenously.

In erysipelas the initial dose, usually 10,000 units, irrespective of the age of the patient, is given intramuscularly and repeated at 24-hour intervals until the skin lesions are arrested and the edema commences to subside. In certain refractory cases in which no response is obtained, even after several injections, serum treatment should be discontinued. The serum may have little effect upon the development of complications or the recurrence of attacks.

In other streptococcal infections serum therapy must be considered in the experimental stage. Intramuscular or intravenous injections of large repeated coses at 12- or 24-hour intervals are suggested, following in general the method for the intravenous treatment of pneumonia.

For precautions against anaphylactic reactions, see page 26.

Streptococcus toxin for the intracutaneous test of susceptibility. The intracutaneous test to determine susceptibility to a standard streptococcus toxin is performed similarly to the test for susceptibility to diphtheria toxin (Schick) and should be carried out with the same accuracy.

Outfits are distributed on special request to health officers and other physicians familiar with the test and experienced in the interpretation of results.

The test consists of the injection into the skin of *one skin test dose* of a standard streptococcus toxin. When a skin reaction develops, susceptibility to the toxin is indicated; a reaction measuring 10 mm. or over is considered positive. When the test is performed to determine whether immunity has been established after active immunization with the toxin, the dose of toxin used is increased to *two skin test doses.*

The skin reaction appears much sooner with streptococcus than with diphtheria toxin and is usually much less marked. It develops within from six to twelve hours, usually reaches its maximum between twenty and twenty-four hours, and fades within forty-eight hours. A strongly positive reaction may occasionally be followed by pigmentation with very slight or no scaling. The readings should be made in a bright light from twenty to twenty-four hours after the injection. A circular giving directions for its use and the interpretation of reactions accompanies each outfit.

Streptococcus toxin for active immunization. Streptococcus toxin for the active immunization of persons found by the intracutaneous test to be susceptible to the toxin is distributed only on

special request. There is evidence that an immunity may be developed within two weeks following the injections of the toxin, but how long this immunity will continue or how reliable it will prove is not known. Moreover, the large number of immunizing doses apparently required and the relatively large amount of toxic filtrate contained in them, would appear to make the treatment impracticable for general use. Under certain conditions, however, such as in outbreaks of scarlet fever in institutions or in the case of nurses in training, the use of the toxin may prove of value. The outfits are distributed with the understanding that the physician will report promptly on their use, and that, if the individual immunized later develops streptococcal infections such as scarlet fever or erysipelas, the fact will be reported.

For purposes of immunization, five and possibly six subcutaneous or intramuscular injections of increasing doses of toxin are given at 5- to 7-day intervals. Two weeks after the last injection, in order to determine whether active immunity has been established, the intracutaneous test of susceptibility should be repeated with *two skin test doses* of toxin—twice the amount used in the first test. If the test still indicates susceptibility, the immunizing treatments may be continued. Directions for dosage and use accompany each outfit.

Syphilis

Laboratory tests are of the greatest importance in the diagnosis and evaluation of treatment of syphilis. Demonstration of the incitant, *Treponema pallidum*, is essential to early diagnosis. The director of a local laboratory is usually in the best position to collect fluid from the chancre for dark-field examination. When facilities are not readily available or the patient does not wish to be referred to a laboratory, the attending physician, if he is familiar with the procedure, can collect a specimen in an outfit containing sterile capillary tubes (Plate III) and submit it to an approved laboratory. If the lesion has been treated with an antiseptic or for any other reason *Trep. pallidum* is not found, the aspiration of fluid from the enlarged regional glands should be undertaken. The study of such material is of particular importance when the primary lesion is in the mouth, since the morphology of certain of the mouth spirochetes resembles *Trep. pallidum* closely.

Trep. pallidum can usually be found in the initial lesion or in the regional glands as soon as the chancre develops, while a serologic reaction often is not obtained until several weeks after infection.

Thus, the importance of careful search for the inciting micro-organism cannot be overstressed.

In case *Trep. pallidum* is not demonstrated in a suspicious lesion, repeated dark-field examinations should be made on several consecutive days, and blood for serologic tests should be submitted.

During the secondary stage of a syphilitic infection, the blood reacts in almost one hundred per cent of cases. Thus at a time when the disease is especially communicable, serologic tests are most dependable as an aid in diagnosis.

In the tertiary and latent stages, the percentage of reactions obtained is lower than in secondary syphilis. However, many such cases that would otherwise be overlooked are detected by means of serologic tests. Experience has shown that all patients who enter a hospital or require medical examination should have a serologic test for syphilis made. Legislation has been enacted that requires the submission of specimens from pregnant women (Public Health Law, Art. II-A, Sec. 18-d) and from applicants for a marriage license (Domestic Relations Law, Art. II, Sec. 13-a).

Specimens for serologic tests for evidence of syphilis should not be collected when the patient is acutely ill with some other disease.

The degree of reactivity in serologic tests is as important in syphilis as it is in other infectious diseases, and especially since clinical signs are so often lacking or indeterminate. Hitherto, the methods for precipitation and complement fixation have not provided a reliable titration of the specific activity. The new procedures developed and adopted by the central laboratories in Albany, also established in the Branch Laboratory in New York, and in some of the approved laboratories, titrate the reactivity of syphilitic serum. The numerical values reported are an index of the titer. A titer of 1.5 has been observed with an extremely small percentage of specimens from healthy individuals. Titers of 1.5 or less are reported as no action, although they have been recorded in known cases of syphilis when intensively treated. Whether or not titers slightly in excess of 2 occasionally occur in conditions other than syphilis is not known; therefore the significance of reactions of this degree should be carefully considered by the clinician.

As a rule, the higher the titer, the greater is its significance in diagnosis. Specimens with titers greater than 6 have given reactions of complete fixation (4+) with the previous method. Titers up to 2,000 have been determined in a few cases under special investi-

gation, but at the present time reports differentiate only those sera with titers up to 10, that is, relatively weak or moderate activity, which is the range of the practical test adopted at the present time. The test is not only valuable in differentiating sera of low or moderate activity, but also in avoiding prozone reactions, such as occur with highly active sera in some of the commonly used tests.

In the central and branch laboratories, two preliminary procedures—a flocculation test and a complement-fixation test—serve to eliminate specimens that do not react. Both procedures are definitely oversensitive and neither is controlled. If evidence of a significant degree of reaction is obtained by either method, the specimen is fully tested. Negative findings in the preliminary procedures permit an immediate report. A large percentage (over 80 per cent) of the specimens being thus eliminated, an opportunity is afforded to make a complete study of reacting specimens and those with which for any reason atypical or unsatisfactory findings are obtained.

While the value of examining the blood is now almost universally appreciated, the necessity for the study of cerebrospinal fluid may not be so generally recognized. The detection of beginning neurosyphilis, or the ability to assure a patient, after he has had adequate treatment, that his cerebrospinal fluid is entirely normal is of vital importance. Thus, the cerebrospinal fluid of every patient who has been found to have syphilis should be examined at least once after treatment and a period of observation. Of course, at any time, in case neurologic symptoms of syphilis develop or the blood of the patient continues to react after he has had intensive treatment (this not infrequently occurs when there is involvement of the central nervous system), the study of the cerebrospinal fluid is imperative.

As in the case of early syphilis, the director of a local laboratory is in a strategic position to assist the clinician through the study of specimens of cerebrospinal fluid. Such a study should include:

1. Macroscopic appearance
2. Determination of the cell content
3. Estimation of the protein content
4. Serologic tests (the results obtained with the cerebrospinal fluid should be compared with those secured with a specimen of blood collected on the same day)
5. Colloidal gold reaction

The results of laboratory tests for evidence of syphilis should be interpreted in the light of the clinical signs and history. Whenever they are at variance with other data concerning the case, specimens for confirmatory examination should be taken.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, the following material should be submitted for examination to a laboratory approved for the purpose: (1) fluid from the lesion to be examined for *Treponema pallidum* (chancre fluid outfit containing capillary tubes, Plate III); (2) 10 ml. of blood for the complement-fixation (Wassermann) test (syphilis tube outfit); (3) when laboratory tests fail to disclose evidence of syphilitic infection, 10 ml. of blood for the complement-fixation (Wassermann) test, taken at weekly intervals until eight weeks have elapsed following the appearance of the primary lesion, unless evidence of syphilis is obtained earlier.

Method for collecting chancre fluid.—The lesion should be washed with sterile physiologic salt solution, and rubbed firmly with sterile gauze (a compress of 2 per cent novocain applied for a few minutes will aid in obtaining the deep exudate). After the blood has been removed, the tissues at the base of the lesion should be gently compressed until a drop of clear serum exudes on the abraded surface. The specimen can then be collected by touching this drop with the end of the capillary tube, which should be held in a horizontal position with the opposite end open. The serum or plasma will then rapidly enter the tube owing to capillary action. It should be sealed by pressing each end into the wax in the amber glass vial accompanying the outfit. While this is done, the tube should still be held in a horizontal position. (See Plate IV.) Repeated tests are desirable, as failure to demonstrate the spirochetes does not exclude syphilis. If an antiseptic or other local treatment has been administered, a salt-solution compress can be applied and the patient instructed to return on successive days for the collection of specimens or, in case the regional glands are enlarged, a specimen may be taken from them. A specimen should always be examined from the latter source when the chancre is located in the mouth, or when there is a question of mixed infection or balanitis.

When material is to be collected from the regional lymph nodes, those which are indurated, shotty, and nontender should be chosen. A few drops of sterile salt solution should be injected into the gland while the point of the needle is rotated to break apart some of the tissue at its tip. A little of the fluid should then be withdrawn for examination. A 1-2 ml. syringe attached to a 22- or 24-gauge needle should be used for the purpose. While collecting the specimen, the gland should be immobilized by grasping it so that the skin is drawn tightly over it. Care should

be taken to have the point of the needle enter the gland and not the surrounding tissues. The aspirated fluid (which should contain very little blood) may then be deposited from the syringe upon a clean glass surface such as that of a slide or the side of a flat bottle, and collected in capillary tubes in the manner described for fluid from a chancre.

Method for collecting specimens of blood.—Specimens of blood, approximately 10 ml., should be taken preferably in the morning before breakfast or at least not within three or four hours after a meal, particularly when alcoholic beverages have been used.

If a blood-letting needle is used, the stylet should be removed and the needle attached to the sterile tube, precautions being taken to avoid contamination of the needle, the cork, or the inner surface of the tube. (See Plate V.) The needle should be returned to the laboratory in the envelope provided for this purpose.

Syringes for the collection of blood should be sterilized by heating and permitted to cool before use. If a syringe has been boiled, it should be rinsed in sterile physiological salt solution (about one-half a teaspoonful of salt to a glass of water). The blood should be transferred to the sterile tube immediately, before it coagulates in the syringe or needle. The tube should be left undisturbed in a slanting position at room temperature for one-half hour.

Method for collecting cerebrospinal fluid.—Proper collection of the specimen is of particular importance. The collection of no more than 5 ml. of fluid can be recommended as a routine procedure.

Since determination of the pressure of the cerebrospinal fluid is not necessary in an examination for evidence of syphilis of the central nervous system, apparatus for this purpose need not be used, thus lessening the chance of contamination. When a lumbar puncture is made, two needles, thoroughly cleansed and sterilized in dry heat, should be available. They should have been carefully sharpened, since the use of a dull needle is usually responsible for admixture of blood in specimens of cerebrospinal fluid. If there is evidence of blood in the fluid, the tap should be discontinued and another puncture made with a fresh needle in the next interspace above the one that has been entered. Blood, oil, or any other foreign material in the cerebrospinal fluid usually renders it unsatisfactory.

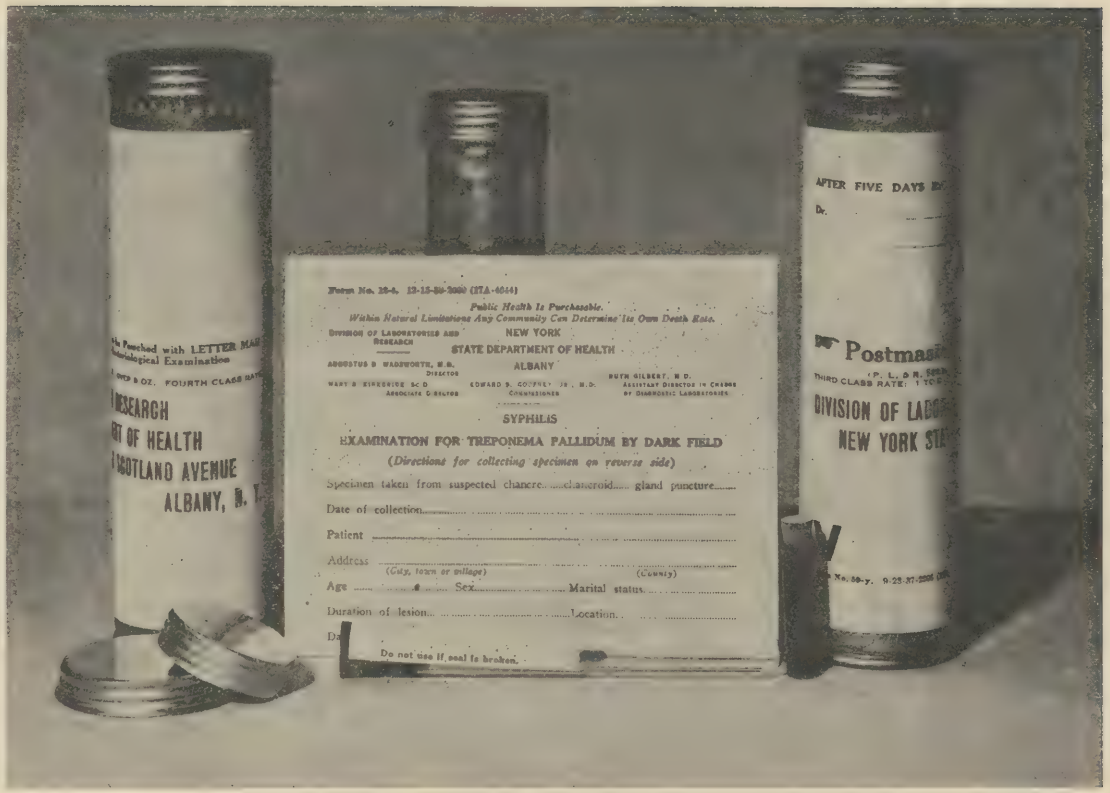
Centrifugation of cerebrospinal fluid before submission for examination is most undesirable. In the case of a bloody tap, should most of the cells be thus removed, sufficient blood serum may remain, undetected, to affect the result of the serologic test. In the event that the specimen is from a syphilitic who does not have syphilis of the central nervous system, a reaction might occur when negative findings would have been obtained had the cerebrospinal fluid been uncontaminated with blood; that is, a reaction is obtained with the reagin in the blood that has contaminated the cerebrospinal fluid. Also, study of the cellular elements in cerebrospinal fluid may yield information of great value in diagnosis. Consequently, it is important that the whole specimen as collected be available for laboratory tests.

Whenever a specimen of cerebrospinal fluid is submitted for examination, a specimen of the patient's blood should accompany it.

Products Supplied by the Laboratory

Arsenical and bismuth preparations. Arsenical and bismuth preparations are purchased and distributed to physicians and clinics through most of the district laboratory supply stations. The drugs are at present supplied in the following amounts: arsphenamine, 1.0- and 3.0-gram ampoules; Mapharsen, 0.06- and 0.6-gram neoarsphenamine, 0.6- and 3.0-gram; sulpharsphenamine, 0.45-gram; bismuth salicylate in oil, 30- and 100-ml. bottles. Distilled water is also distributed for use by physicians and small clinics when not otherwise available. A request form for use by physicians in securing these drugs may be obtained from custodians of supply stations and district state health officers from whom further information may be secured.

When all necessary precautions are observed, marked reactions associated with the administration of these arsenicals are rare. Any unusual reaction occurring during or after injection should be reported immediately and in detail to the central laboratory. The kind of material given and the lot number should be specified. Instructions for the preparation of the solutions and the method of administration will be found in the circulars enclosed in each package.

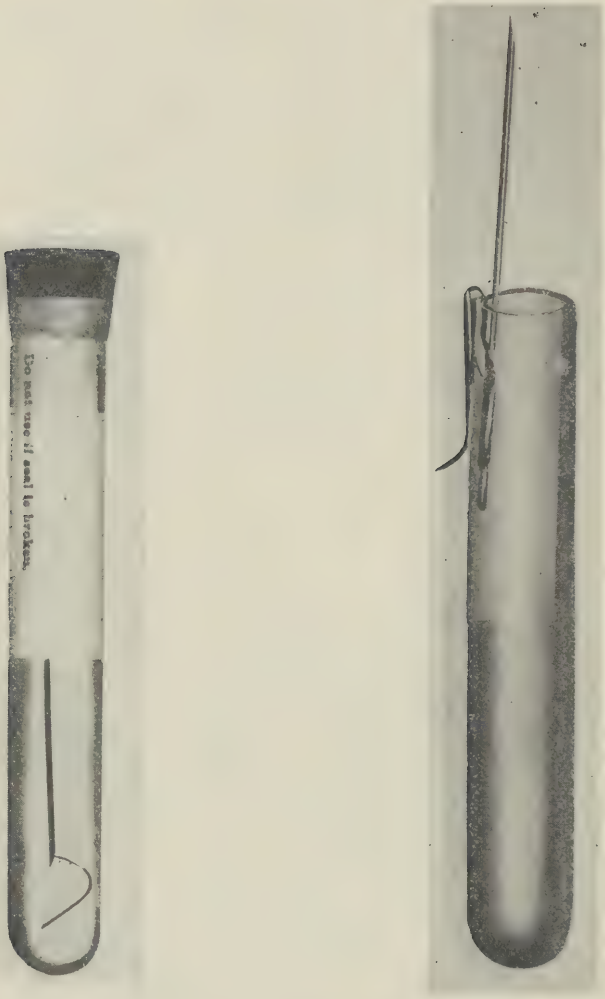


CHANCRE FLUID OUTFIT CONTAINING CAPILLARY TUBES

PLATE IV

Sealing Capillary Tube with Wax

PLATE V



A B

TUBE FROM SYPHILIS OUTFIT

A. WHEN CORK IS REMOVED, LABEL IS BROKEN

B. ATTACHMENT OF BLOOD-LETTING NEEDLE WHEN SPECIMEN IS COLLECTED

Tetanus

Tetanus, like diphtheria, is essentially an intoxication. The tetanus bacillus (*Clostridium tetani*) grows only at the site of inoculation, usually a wound into which some infectious material such as soil contaminated with animal excretions has been forced. In dirty wounds, the microorganism finds favorable conditions for its development and produces one of the most powerful toxins known. A certain latent (incubation) period, proportionate in length to the distance of the portal of entry from the central nervous system, elapses before the symptoms appear.

Specimens for Laboratory Examination

As considerable time may be required for the demonstration of *Cl. tetani* in the exudate of an infected wound, the laboratory can be of little assistance in making an early diagnosis.

Product Supplied by the Laboratory

Tetanus antitoxin: *Passive immunization.* Experience has shown that the subcutaneous injection of an immunizing dose of tetanus antitoxin rarely fails to prevent the development of the disease. When injury, resulting in a lesion favorable for the growth of tetanus bacilli, has occurred, a preventive injection of the antitoxin should be given subcutaneously at the time the wound is treated or as soon thereafter as possible. This is especially important in the case of gun shot or similar wounds or wounds in which garden, street, or stable dust or dirt has come in contact with the injured tissues. While one injection is generally sufficient, if the condition of the wound continues favorable for the development of tetanus infection, an additional subcutaneous injection should be given within five days and, under exceptional circumstances, even a third. The concentrated antitoxin prepared by the State laboratory is available through the supply stations in packages containing 1,500 units.

Curative treatment. While the typical symptom complex of tetanus is unmistakable, the early evidences of the disease are frequently overlooked. Since to be of value it is essential that antitoxin be administered at the earliest possible moment, brief delay in diagnosis or in treatment may remove all possibility of recovery. By the time the first symptoms appear, the disease is well advanced and all that can be reasonably expected of the treatment is the prevention of absorption of further amounts of active toxin by the nervous system. At the onset any tetanus antitoxin avail-

able in the local supply stations, whether intended for treatment or immunization, should be used and an additional supply requisitioned at once by telephone or telegraph from the central laboratory or from the branch laboratory in New York City. The antitoxin is distributed in packages containing 20,000 units for therapeutic use. A circular of directions is contained in each package.

Administration. Prophylactic dose. The initial preventive dose is 1,500 units of antitoxin injected subcutaneously. For young children from 800 to 1,000 units may be given. In the case of a deep-seated and necrotic wound that has failed to heal, or a more superficial gun shot or similar wound, the injection should be repeated, from 1,000 to 1,500 units being given within five days after the initial dose. When the condition persists, a third and even a fourth injection after a similar interval may be advisable. In especially bad wounds larger as well as repeated doses may be needed. Should more than three days elapse between injections, the danger of severe anaphylactic shock should be borne in mind.

Therapeutic dose. The antitoxin is administered intraspinously, intravenously, and intramuscularly. The intraspinous method appears to be the most effective, while the intravenous, owing to prompter absorption, is preferable to the subcutaneous method. Statistics compiled from cases treated in the State indicate that there is marked advantage in combining intraspinous and intravenous injections. Since antitoxin should be administered at the earliest possible moment and in adequate amounts, the first dose in experienced hands is given intraspinously, followed immediately by an ample intravenous dose if the patient is not oversensitive to horse serum. Treatment should be continued depending upon the clinical signs, using intramuscular administration unless the severity of the symptoms requires continuance of the intraspinous and intravenous treatment. A large intramuscular dose distributed among several muscles should be given at once if the first intraspinous and intravenous injections are unavoidably delayed. Administration by cisternal puncture has been recommended.

(a) Intraspinous injections of from 10,000 to 40,000 units repeated at 24- and 48-hour intervals.

(b) Intravenous injections of from 20,000 to 40,000 units repeated at 24- to 48-hour intervals.

(c) Intramuscular injections of from 10,000 to 20,000 units. For precautions against anaphylactic reactions see p. 26.

Trichinosis

Trichinosis is incited by *Trichinella spiralis* and results from eating raw or improperly cooked meat, usually pork, containing the living encysted larvae of the parasite, which are readily destroyed by thorough cooking. The larvae have been found to remain alive for several weeks in certain kinds of smoked sausages which are eaten uncooked.

The trichinella reaches the adult stage in the intestine, where breeding takes place. After from five days to three weeks, the embryos migrate to various parts of the body and, if not destroyed, become encysted in the muscle fibers. Trichinella larvae have been found in blood, cerebrospinal fluid, and feces. However, indications of infestation are not usually evident until the parasites have reached the muscles. Examination of blood, cerebrospinal fluid, or feces for the parasites is then in most cases useless.

Blood counts furnish information of material value in diagnosis. A leucocytosis with marked eosinophilia is the characteristic finding.

Specimens for Laboratory Examination

Sections of muscle in 10-per-cent formalin may be submitted to be examined for trichinellae, as well as blood films for a differential leucocyte count. In case the work can be done in a nearby laboratory, a total leucocyte count is also desirable.

If possible, a portion of the meat or meat product thought to be the source of infestation should also be submitted for examination.

Tuberculosis

The aid in diagnosis which the laboratory can furnish by demonstrating tubercle bacilli in sputum or other types of specimens is too generally recognized to require emphasis. Tubercle bacilli, however, will not be present in specimens unless the tuberculous process has progressed sufficiently to provide necrotic material which contains the bacteria. Thus, in pulmonary tuberculosis, evidence of the disease can be demonstrated by means of x-ray and clinical manifestations before tubercle bacilli can be found.

Experience is gradually accumulating which demonstrates the practical value of the complement-fixation test of the blood serum as an aid in the diagnosis of tuberculosis. With a sensitive form of test, such as that used in the central laboratory in Albany, a

large number of reactions is obtained with sera from patients with active tuberculosis. The reaction occurs in from 85 to 95 per cent of active pulmonary infections and in a smaller percentage, 50 to 70 per cent, of extrapulmonary forms of the disease. The infrequent and low-grade reactions obtained in inactive cases indicate that the reaction of the serum diminishes or disappears with healing of the lesions and apparent arrest of the disease.

Reactions with tubercle antigens have been reported to occur in the sera of persons suffering from syphilis, malaria, and leprosy. Experience at the central laboratory with cases of malaria and leprosy has been limited. In the sera of patients with leprosy, reactions are frequently obtained and are usually marked in degree. In fact, the proportion of marked reactions is greater than is commonly observed in patients with tuberculosis. In syphilis, while reactions occur, they are quite uniformly of low grade. Serologic tests for syphilis are performed, as a control, on all specimens submitted for the complement-fixation test for tuberculosis.

Specimens for Laboratory Examination

Sputum coughed from the deeper portion of the respiratory tract, preferably in the morning, or exudate from lesions believed to be tuberculous, may be submitted in jar outfits without preservative, to be examined for tubercle bacilli. Since children usually swallow sputum, the examination of stomach washings from these patients may be desirable. Blood may also be sent for the complement-fixation test (tuberculosis tube outfit).

In tuberculosis of the intestines, examination of fecal specimens usually provides information of less diagnostic significance than clinical and x-ray findings. Patients with pulmonary tuberculosis often swallow sputum, and thus the finding of tubercle bacilli in feces may not be indicative of a tuberculous involvement of the intestines. Also, specimens of feces may contain nonpathogenic acid-fast bacilli known as smegma bacilli.

Usually, specimens of urine collected aseptically from each ureter should be studied and guinea pigs inoculated with each when the patient has symptoms of tuberculosis of the kidney. If acid-fast bacilli are found in non-catheterized specimens of urine, the possible presence of smegma bacilli should be considered.

The results of laboratory examinations may be helpful in confirming the diagnosis when a patient has symptoms of tuberculous

meningitis. In most instances, a fibrin web collects in cerebrospinal fluid from patients with this disease. The web entraps most of the tubercle bacilli present. If the specimen is sent through the mail, the web is usually broken and its remnants may adhere to the cork of the tube, thus materially lessening the opportunity for finding tubercle bacilli. The results of animal inoculations with specimens of cerebrospinal fluid from patients with symptoms of tuberculous meningitis are of value only for purposes of confirmation and diagnosis. They are seldom, if ever, available in time to serve as a guide in treatment.

The study of specimens of feces, urine, and cerebrospinal fluid should be undertaken in local laboratories where all of the factors concerned can be evaluated and animals inoculated if desirable.

Product Supplied by the Laboratory

Old tuberculin (Koch's O. T.). The tuberculin test is designed to determine the presence of tuberculous infection. Physicians are cautioned, however, that although the results of the tuberculin test reveal the fact that the tissues have been sensitized by the tubercle bacillus, they should not be considered diagnostic evidence of clinical disease unless carefully interpreted in the light of considerable practical experience with the test and correlated with clinical findings.

Concentrated old tuberculin for diagnostic use is prepared by the Division of Laboratories and Research and distributed through supply stations to physicians experienced in making the test. The number of individuals whom it is planned to test should always be stated. The test may be made by the intracutaneous method (Mantoux), or by the cutaneous method (von Pirquet). Because of its greater accuracy, the intracutaneous method is recommended. The directions enclosed in each outfit should be followed closely.

The test. Intracutaneous method: The tuberculin is diluted with sterile, freshly prepared salt solution so that the required dose is contained in 0.1 ml. Great accuracy should be observed in making the dilutions. For the initial test of children under eight years old, 0.1 ml. of a 1:10,000 dilution is advised; for older children and adults, 0.1 ml. of a 1:1,000 dilution. The dose is injected intracutaneously on the inner surface of the left forearm. The reaction is considered positive when an infiltration and hyperemia develop at the site of injection in from six to eight hours, reaching a maximum in from twenty-four to forty-eight hours and then gradually subsiding. Readings should be made at 24- and

48-hour intervals. If no definite reaction is obtained after the first injection, especially in a case that according to the history or clinical symptoms is suggestive of active tuberculosis, the injection should be repeated with a lower dilution.

Cutaneous method: Two small scarifications one-fourth inch long and three inches apart are made, without drawing blood, on the left forearm. On one scarification a drop of the concentrated tuberculin is placed with a sterile needle, and is then spread gently over the surface. The second scarification is not treated and serves as a control. An inflammatory reaction developing where the tuberculin was applied and distinct from any traumatic reaction in the control area, constitutes a positive reaction. This usually appears in from twelve to twenty-four hours and subsides after from three to four days.

Tularemia

B. tularense, the incitant of tularemia, is acquired by man from an animal source. Rodents, especially rabbits, appear to be particularly susceptible, although many other species of animals, as well as birds, have been found to have the infection. *B. tularense* is transmitted from animal to animal and from animals to man by blood-sucking insects, as well as by direct contact in handling and dissection of animals. Transmission from man to man by contact or by the bite of insects that have previously bitten a patient has not been reported.

Experience has indicated that *B. tularense* infection is rare in rabbits and other game animals in New York State, although recently information has been obtained that muskrats in the northern part of the State may harbor this species. With very few exceptions, patients who have developed tularemia in this State have handled rabbits shipped from some other part of the country.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, the following material should be submitted for examination to a laboratory approved for the purpose: (1) 10 ml. of blood (typhoid tube outfit); (2) if ulcerating lesions are present, films of discharge on glass slides (slide outfit), and a specimen of discharge on a sterile swab (tube outfit with swab). Dead animals or birds may also be submitted, in which case none of the organs should be removed.

Typhoid and Paratyphoid Fevers

The present sanitary environment of urban districts in New York State is such that the incidence of typhoid fever is very low. The source of the incitant in most cases can be traced to carriers of typhoid bacilli. Carriers who are food handlers represent a particular menace.

The Sanitary Code requirement (Chap. II, Reg. 15) which necessitates the submission of specimens from convalescents who have had typhoid or paratyphoid fever before release from observation should result in the detection of most of the individuals who develop the carrier condition. Nearly all of these carriers have a focus of infection in the gall bladder. Gall stones or other evidence of cholecystitis are usually found when the gall bladder removed from a chronic typhoid carrier is examined.

In hospitals and other institutions, the ease with which incitants of enteric disease can be transmitted with the rectum as the portal of entry must be kept in mind. Improperly sterlized rectal catheters may be the means of transmission. Simply washing enema tubes or soaking them in an antiseptic gives inadequate protection, since the inside of the tubing may remain contaminated.

The results of serologic tests for evidence of typhoid fever are seldom of diagnostic value during the first week after onset of symptoms. When the clots of blood are cultured, however, the incitant is usually isolated, definite confirmation of the diagnosis thus being provided. After the patient has been ill for from ten days to two weeks, the blood usually agglutinates *B. typhosus* markedly. Total and differential leucocyte counts are useful, since a leucopenia and the presence of a relatively high percentage of lymphocytes are characteristic findings in typhoid fever.

Specimens of feces collected a day or two after onset of symptoms may not be found to contain typhoid bacilli, but the microorganisms can usually be readily isolated from those collected later during the acute stages of the illness and they may be present for a considerable time after convalescence. When these bacteria are found in specimens from a person who has not suffered from typhoid fever within one year, he is considered a chronic typhoid carrier (Sanitary Code, Chap. II, Reg. 31).

Typhoid bacilli are present in the urine of a fairly high percentage of patients with typhoid fever. They are found also in discharges from focal infections and occasionally in cerebrospinal fluid and sputum.

If a cholecystectomy is considered desirable in order to free a typhoid carrier who has a focus of infection, duodenal contents should first be examined to prove that the bile contains these bacteria. Such specimens should also be studied after the gall bladder has been removed. Typhoid bacilli may be present in specimens of duodenal contents from three months to a year after removal of the gall bladder and yet the focus may later become inactive.

Paratyphoid fever presents problems similar to those encountered in typhoid fever. Certain diseases of rodents and domestic animals are incited by strains of bacteria that cannot be easily differentiated from *B. paratyphosus* and that are difficult to identify. Man is susceptible to infection with many of these microorganisms, for example, *B. suipestifer* (*Salmonella cholera suis*). Infections with such species of bacteria probably result from the contamination of food by the excreta of rats or mice or from contact with domestic animals.

Specimens for Laboratory Examinatiton

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, the following material should be submitted for examination to a laboratory approved for the purpose: (1) 10 ml. of blood (typhoid tube outfit); if this is not practicable, from two to four drops collected on a glass slide and allowed to dry (slide outfit); (2) a specimen of fluid feces (typhoid jar outfit containing 30-per-cent buffered glycerol) and, if there is evidence of localization in the genitourinary tract, a specimen of urine (typhoid jar outfit containing 30-per-cent buffered glycerol). The 30-per-cent buffered glycerol inhibits fermentation and has thus proved efficient in preserving specimens of the type mentioned, when transmitted through the mail.

When duodenal contents are to be collected from carriers, the specimens should be examined in local laboratories if possible. After the tip of the drainage tube has reached the duodenum, several specimens of the fluid should be collected for bacteriologic examination. Only fluid that is neutral to litmus or very slightly acid or alkaline is usually satisfactory for cultural tests. When acid, the typhoid bacilli, if present, may be killed. The introduction of sterile sodium bicarbonate may be desirable to neutralize the acid. After the tip of the tube has reached the duodenum, administration of magnesium sulfate will promote the flow of bile and thus improve the opportunity for the detection of *B. typhosus*

if present in the gall bladder. The inconvenience to the patient occasioned by passing the tube warrants the collection and examination of several specimens of duodenal contents at 15- or 20-minute intervals, so that at least some of them will be satisfactory.

Product Supplied by the Laboratory

Typhoid vaccine. The administration of typhoid vaccine has proved to be an effective preventive against typhoid fever. The duration of the protection afforded may be a year or possibly a considerably longer period. It should be borne in mind, however, that the immunity induced by this vaccine is only relative; it may not be sufficient to protect against frequent and massive doses of the infective agent. The vaccine is not recommended as a therapeutic agent to be used after the disease has developed.

Typhoid vaccine is prepared by the Division of Laboratories and Research and distributed through district laboratory supply stations in bottles containing three doses for the immunization of one person, and in larger bottles containing 10 ml. for use when a number of persons are to be immunized at the same time. Each milliliter of the vaccine contains 1000 million killed bacilli.

Administration. The vaccine should be injected subcutaneously, usually over the insertion of the deltoid. Three doses are usually administered at intervals of from seven to ten days, the first dose being 0.5 ml., the second and third doses 1 ml. each. Although the dosage should not exceed the standard amounts recommended, slightly smaller doses may be given in order to reduce the severity of the reactions occasionally induced by the injections. If the dose is materially reduced, however, the number of injections should be correspondingly increased. The dosage for children should be reduced in proportion to the body weight as compared with that of an adult.

The reaction induced by the vaccine varies; it may be practically negligible but usually consists of localized congestion with redness, swelling, and tenderness. These local reactions may be accompanied by varying degrees of systemic disturbance, general malaise, and fever. Pronounced systemic reactions are, however, rare and are transitory in character. It is advisable to give the injections late in the afternoon so that if a reaction occurs it will be at night. The injections should be postponed in case of illness, after the fifth month of pregnancy, or during the menstrual period. Great care should be exercised in cases of cardiac disease and

nephritis—conditions which should be considered contraindications. The same is true of tuberculosis in the active stages, although typhoid vaccination in the latent or inactive stages is considered a safe procedure.

Full directions for dosage and administration are given in the circular that accompanies each bottle of vaccine.

Because of the apparently low incidence in New York State of paratyphoid infections and the wide variations in the immunologic properties of the incitants of these infections, the distribution of the combined typhoid-paratyphoid vaccine has been discontinued. This is in accord with the procedure now generally adopted.

Typhus Fever and Rocky Mountain Spotted Fever

Both typhus fever and Rocky Mountain spotted fever are incited by rickettsiae and transmitted by insect vectors. Ticks are involved in the latter and lice and other ecto-parasites, in the former. Rocky Mountain spotted fever has been found to occur on Long Island, and a mild form of typhus fever, known as Brill's disease, is occasionally reported in the city of New York. Differentiation of the incitant of Rocky Mountain spotted fever from that of typhus fever requires the use of a considerable number of laboratory animals and is too time-consuming for the findings to be of value in diagnosis. The blood of patients with either of these diseases, however, has been found to agglutinate certain strains of *B. proteus*.

Specimens for Laboratory Examination

In accordance with Chap. II, Reg. 9, of the Sanitary Code, whenever typhus fever is suspected, the following material should be submitted for examination to a laboratory approved for the purpose: (1) 10 ml. of blood (typhoid tube outfit); and (2) a specimen of feces to be examined for evidence of typhoid fever (typhoid jar outfit containing 30-per-cent buffered glycerol).

A similar procedure can be recommended when a diagnosis of Rocky Mountain spotted fever is considered.

Undulant Fever

Until a comparatively few years ago, undulant fever was thought to be incited only by *Brucella melitensis* and to be restricted in distribution to districts where the milk of goats was used as a beverage. Man was believed to be immune to infection with *Brucella abortus*, the incitant of abortion disease in cattle,

to which hogs are also susceptible. Investigation has proved, however, the fairly close relationship of the strains of bacteria belonging to the abortus-melitensis group, and that all of them are pathogenic for man. In New York State the number of hogs and goats raised is not large and these animals are of negligible significance as sources of the incitant of undulant fever. In nearly all instances, patients with this disease have been found to have used raw milk from cows with infectious-abortion disease or to have handled such animals. The very small number of cases of undulant fever reported in the city of New York where all but a very small percentage of the milk is pasteurized and few of the residents handle cattle, indicates that butter, cheese, and uncooked meat which may be handled by the housewife do not represent a significant source of the incitant of undulant fever. Men in slaughter houses, however, who come in contact with the tissues of diseased animals frequently acquire *Br. abortus* infection. A considerable percentage of patients with undulant fever develop chronic foci of infection; for example, cholecystitis or spondylitis may be incited by *Br. abortus,* or these bacteria may remain viable in an ovarian cyst.

The clinical manifestations of infections with members of the abortus-melitensis group of bacteria are markedly varied; in fact such cases may first be diagnosed as typhoid fever, malaria, influenza, tuberculosis, melancholia, or neurasthenia. Thus, the results of laboratory tests are of particular value. While the serum from most patients with undulant fever agglutinates *Br. abortus* in a 1:80 or higher dilution, no reaction or one of low titer only may be obtained early in the disease. When chronic foci develop, a marked reaction sometimes occurs, but in such cases low titers are not unusual.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, 10 ml. of blood (typhoid tube outfit) should be submitted for examination to a laboratory approved for the purpose. Blood may also be collected in citrate solution for cultural examination.

Note. A limited supply of *Br. abortus* vaccine is prepared and maintained by the central laboratory in Albany. While published reports and those received by this Division indicate wide variation in the results of vaccine therapy, the data accumulated appear sufficiently encouraging to warrant further trial in suitable cases. Requests for the vaccine, made directly to the central laboratory, should give the significant facts concerning the case. Recommendations relating to dosage and administration are mailed to the physician.

Vincent's Angina

A diagnosis of Vincent's angina must be based largely on the clinical manifestations. The spirochetes and fusiform bacilli found in lesions of Vincent's angina are often present in other types of lesion in the mouth or throat. They are usually present in the necrotic material around the teeth of patients with pyorrhea. Films from the surface of the membrane in diphtheria may be found to contain large numbers of fusiform bacilli and spirochetes. Hence, the presence of these microorganisms requires careful evaluation.

Specimens for Laboratory Examination

In accordance with the requirements of Chap. II, Reg. 9, of the Sanitary Code, the following material should be submitted for examination to a laboratory approved for the purpose: (1) films of the exudate on glass slides (slide outfit); (2) a culture from the exudate on Loeffler's blood-serum medium, to be examined for diphtheria bacilli and hemolytic streptococci (diphtheria culture outfit).

Whooping Cough

Laboratory aids in the diagnosis of whooping cough are unnecessary when the patient has characteristic symptoms. In the case of children who have not yet developed the "whoop" or adults in whom the manifestations may not be typical, bacteriologic findings may be very helpful.

A special medium is necesesary for the isolation of *Hemophilus pertussis*. The work can best be done in a nearby laboratory. When an examination for the presence of *H. pertussis* is desirable, the patient is induced to cough on suitable medium in a Petri plate, or freshly collected sputum can be washed in sterile physiologic salt solution and streaked on the medium.

Product Supplied by the Laboratory

Pertussis vaccine. Pertussis vaccine is used as a prophylactic and therapeutic agent. Its value cannot be determined from the conflicting reports in the literature. Dosage and controls have been, in many instances, inadequate. While the results are indeterminate, there appears to be sufficient evidence to warrant the use of the vaccine, especially when given for preventive purposes, provided a sufficiently concentrated preparation is employed. Few, if any, reactions of clinical significance have been recorded.

The vaccine prepared by the State laboratory is distributed through district supply stations in bottles containing three doses, for the immunization of one person, and in larger bottles containing 10 ml. The vaccine contains 10,000 million microorganisms per milliliter. It should be kept at a low, even temperature.

Administration. The vaccine is injected subcutaneously. Just before the vaccine is withdrawn, the bottle should be vigorously shaken to make sure that the bacilli present as a thick mucoid sediment are suspended evenly in each dose. When the vaccine is used as a preventive, three injections are usually given, three to seven days apart; for therapeutic treatment, at least four or five injections are given, one every second to fourth day, depending upon the clinical symptoms. Full directions for dosage and administration are given in the circular contained in each package.

Miscellaneous Examinations

Microscopic, cultural, and chemical examinations of blood, urine, and other body fluids, secretions, excretions, exudates, and transudates, and histologic examination of tissues may furnish valuable aids in the diagnosis, prognosis, and subsequent treatment of many types of disease processes. The local laboratory is in the best position to make these examinations since, in most instances, proximity to the patient is an important factor.

Blood

Chemical examination. The chemical examination of blood is not undertaken at present as a routine procedure either in the central laboratory or in the branch laboratory, but is included in the service rendered by most of the approved laboratories. When planning to have such tests performed, the physician should first consult the director of the laboratory concerning methods for the collection and submission of specimens.

Cultural examination. While the typhoid bacillus can often be isolated from the blood clot after the specimen has been in transit for a day or more, cultural examination of the blood in most types of bacteriemia should be undertaken promptly after collection of the specimen. Experience has demonstrated that in addition to the usual aerobic procedures, anaerobic methods and provision for from five to ten parts of carbon dioxide in the atmosphere in which the cultures are incubated, adds materially to the value of the work. Also, the opportunity to isolate the inciting microorganism

is increased if from 25 to 50 ml. of blood are cultured. The use of an anticoagulant that inhibits the action of bactericidal properties of the blood serum, or a large volume of culture medium for the same purpose, is desirable.

Microscopic examination and hemoglobin determination. With the exception of the examination of dried films, none of the laboratory aids in diagnosis that can be furnished by studies of the cellular elements and platelets in the blood are successful if the material is submitted by mail. Recent investigations in this field emphasize the importance in diagnosis and prognosis of the number and condition of the various types of cells found in the blood and their relationship to the hemoglobin content. Here again, the director of the local laboratory is in a strategic position to assist the clinician and the surgeon in his district.

Intestinal Parasites

The ova of intestinal worms belonging to the nemathelminthes and the platyhelminthes may be demonstrated in feces. The ova of pinworms *(Oxyuris vermicularis)* can be most easily found if scrapings from the skin around the anus can be examined. Intestinal protozoa, of which amebae are the most important *(See* Amebiasis, p. 29), can usually be demonstrated only when the specimens are examined promptly after collection. Therefore, if possible, the patient should be taken to a nearby laboratory.

Specimens for Laboratory Examination

One or two milliliters of fecal material without preservative (jar outfit) may be submitted for examination.

Tissue—Histologic Examination

The services rendered by competent resident pathologists are of invaluable assistance to surgeons in the study of their cases. Specimens of tissue, therefore, should be examined in a nearby approved laboratory. They should be sent to the Division of Laboratories and Research only when a question has arisen in regard to diagnosis, when there is a difference of opinion concerning the findings, or when a confirmatory examination is desirable. Pertinent data relative to the clinical manifestations, operative findings, and treatment of the patient should accompany all specimens.

Tissues for histologic examination should be placed in fixative immediately after removal, since the most important step in their

preparation is proper fixation. If this procedure is not followed, post-mortem changes often render the material unsatisfactory for examination. A 10-per-cent solution of formalin is the best fixative for routine use; the volume should be at least ten times that of the tissue. Whenever possible, all of the specimen that is removed, rather than a portion of it, should be sent to the laboratory. Large specimens should be shipped by express in containers of adequate size, such as fruit jars; they should be incised to permit proper penetration of the formalin. If, for any reason, the entire specimen cannot be sent, small pieces of the abnormal areas may be excised. Uterine curettings should be selected, separated from the blood, placed on a piece of gauze, and put in formalin at once.

Occasionally, a cultural examination or an animal inoculation is desirable. Under such circumstances, some of the material should be collected on a swab, or the specimen should be divided and a portion sent in a sterile jar without preservative and the remainder in one containing formalin.

If a microscopic examination of the tissues removed at an autopsy is desired, representative pieces of each organ should be submitted as previously described, accompanied by a detailed history of the case, including the gross necropsy findings.

In accordance with the provisions of the Sanitary Code (Chap. IV, Reg. 7), representative specimens, or sections for microscopic examination, of tissue removed at operation or at necropsy that require laboratory examination as an aid in the diagnosis, prevention, or treatment of disease, or to determine the cause of death, should be submitted to an approved laboratory.

Urine

Chemical and microscopic examinations. Since no preservative has been found entirely satisfactory in preventing decomposition in urine, chemical and microscopic examinations are essentially local laboratory procedures. The urine should be collected in a clean receptacle, free from acid or alkalis, and sent to the laboratory promptly. For quantitative sugar determination, a portion of a 24-hour specimen should be submitted.

Cultural examination. In case of infections of the urinary tract, a specimen collected aseptically should be examined promptly after it has been obtained.

Autogenous Vaccines

Isolation of cultures. Since the first requisite for an autogenous vaccine is the incitant of the lesion, the cultural examination should be undertaken promptly after collection of the specimen to obviate the possibility of overgrowth by contaminating microorganisms and of destruction of the pathogenic species.

Autogenous vaccines are not prepared as a routine procedure by the Division of Laboratories and Research. Since the etiologic relationship of a particular microorganism to a subacute or chronic infection is often difficult to establish from bacteriologic study alone, work of this type, when required, should be undertaken in a local approved laboratory.

PART III

EXAMINATION OF WATER, SEWAGE, AND SEWAGE SLUDGE

Water

Samples of water are examined at the request of directors of the divisions of the State Department of Health, district state health officers, district sanitary engineers, and local health officers. Individuals are referred to the local health officer; if in his judgment examinations to determine sanitary quality are necessary or desirable, they are made, but only if he collects the samples in containers supplied by the laboratory, and furnishes a record of the sanitary conditions at the source of the supply. Samples from private sources are examined only for the sanitary quality of the water; for mineral analyses the owner is referred to a private laboratory for a special study of the particular problem.

The health officer should state his reason for requesting a laboratory examination in his investigation of a water supply, as well as the number of samples it is proposed to collect for chemical and bacteriologic examination. Since a single bacteriologic examination may not reveal intermittent pollution, a sample for chemical analysis should be collected from all privately owned sources where previous examinations have not been made. Samples for chemical analysis should also be collected from recently constructed public supplies, and from those in which such problems as taste or corrosive action are to be investigated. If a large sample for chemical analysis is taken, one for bacteriologic examination should also be collected at the same point in the supply, although additional bacterial samples may also be taken from other points if the results are likely to be of significance.

On receiving the containers, the health officer should select the information form descriptive of the water to be examined and answer all questions relating to the conditions found in his inspection: the green card for ground waters (well, spring, infiltration gallery); the cherry card for untreated surface water (stream, pond, or lake); the blue card for treated water.

The laboratory examination determines the presence or absence of pollution at the time of sampling, but the field inspection determines the sources and nature of the pollution and thus the

significance of its presence or absence. Ground waters receive pollution either from surface washings, from subsurface drainage through the soil, or through fissures and channels in rock strata. It is therefore necessary to inspect the well, spring, or infiltration gallery, and to record data to show: (1) whether the well is protected structurally from pollution; (2) the nature and location of, and drainage from nearby sources of pollution; and (3) the character of the soil penetrated.

Surface waters receive pollution at different points from various sources and through tributaries. This pollution is altered by storage and by sedimentation, dilution, and numerous other natural agencies. The number, character, and size of the streams, ponds, or lakes constituting the supply, and the construction, capacity, and operation of storage reservoirs used in distributing it should therefore be recorded. Especially is it necessary to give complete available data concerning the watershed and all probable sources of pollution, as well as all safeguards against contamination.

Various methods of purification and different combinations of these methods are used in the treatment of water; hence, all the data on the blue card are not required in describing any one treatment plant. Since the efficiency of any method, or combination of methods, is dependent upon the precision with which each step of the process is carried out, it is necessary to record the operative details, all of which can be obtained from the person in charge of the plant. Any further information regarding conditions that might affect the sanitary quality of the water, together with an explanatory diagram, should be added under "remarks" or on the blank white card furnished with each outfit for this purpose. Samples, bacterial and chemical, from different points in a source of supply, should be identified by the letters, A, B, C, D, etc., the respective points at which these samples were taken being noted on the descriptive cards. All the cards should be replaced in the envelope in which they are shipped, and the envelope replaced in the wooden box.

Reports are not made unless the sources of supply have been adequately inspected. If the descriptive forms are incomplete, they will be returned and the report of the examination held until the necessary data are furnished.

These containers are shipped by express collect; samples should be sent to the laboratory by express prepaid. The sampling schedule should be timed, and direct shipping routes selected so

as to ensure delivery within twenty-four hours after collection, if possible, and never later than forty-eight hours. Samples should be taken preferably early in the week and not later than Thursday.

Public Water Supplies

As an aid in supervision and to provide data on which the Division of Sanitation may base recommendations for improvement, samples from all public water supplies are examined at scheduled intervals. Chemical examinations are made at least annually; bacteriologic examinations four, six, or twelve times a year. The frequency of sampling depends upon the results of previous examinations and upon known sanitary and operating conditions. When local approved county or city laboratory service is available and reports of monthly or more frequent bacteriologic examinations at these laboratories are submitted to the Department, the supplies are listed for minimum sampling. Occasionally when specific information is desired about a particular problem, the frequency of sampling is increased temporarily. Included in this routine sampling schedule are the water supplies of state institutions, state parks, and a number of selected schools over which close supervision is necessary in the interests of the public health.

The laboratory notifies the health officer or water department official by postal card when a container is sent, and advises when the sample for bacteriologic examination should be submitted. Samples from public supplies examined under this schedule are shipped without refrigeration by parcel post, special delivery, in a container of special design; in this way delivery within twenty-four hours is assured. Experience has indicated that in water not seriously polluted bacterial changes during unrefrigerated storage for twenty-four hours are of little significance, and samples sent by mail as described have been found suitable for examination. Samples without special delivery postage are not examined and another specimen is requested from the same source. It is desirable that the samples be collected on the dates assigned. If unusual local conditions interfere, collection may be postponed until the following week. If the sample is not received within two weeks, a second postal card is sent calling the collector's attention to this fact; at the end of three weeks a letter is written or the district engineer investigates the cause of delay.

The mailing outfits include a brown descriptive card on which all identifying data regarding the sample should be entered, as

well as any other information about the supply. If the water is chlorinated, the residual chlorine value on the day of sampling should be recorded, since it is essential to an interpretation of the laboratory findings. This information can be secured readily from the operator in charge of the treatment; incomplete records are returned for detailed information before the results are reported.

The laboratory findings are sent to the Division of Sanitation for interpretation and submission to the health officer and to the village and water-supply officials.

The information furnished by this sampling procedure has been of great value in the control of water quality and in the establishment of more satisfactory public water supplies throughout the State. When the laboratory results indicate that the sanitary quality of a given supply is questionable, an inspection is made promptly by a member of the staff of the Division of Sanitation.

Collection of Samples

Samples for bacteriologic examination. The small bottles for bacterial samples are sterile and should be handled with care to avoid contamination. If by accident a bottle should become contaminated, or there is any question of its sterility, it should be so marked and a fresh one taken for the sample, or secured from the central laboratory if not available locally.

Taps on a main that is in constant use should be selected as sampling points; never those on a dead end. Leaky taps and hydrants are not suitable as sampling points. The water should be allowed to run for ten minutes before samples are taken.

The hands should be carefully washed and dried before collecting a sample. Test the stopper to be sure that it is loose before removing the cloth. If necessary, loosen it by gentle taps with a pocket knife or similar object. Remove the cloth cover and loosen the edges of the tinfoil. Hold the bottle at or near the bottom with one hand and, with the other, remove the stopper still covered with the tinfoil.

While collecting the sample, be sure that the exposed stopper does not touch anything, that the neck of the bottle is not contaminated by the hands, and that the water does not flow over the hands into the bottle. The bottle should be filled to within half an inch of the stopper, leaving only sufficient air space for expansion. Replace the stopper, pressing the tinfoil around the neck, and tie the cloth securely.

Collection of Samples of Water

FIG. 2

Label each sample with an identifying letter and the name of the city, town, or village, and enter the corresponding identification on the descriptive card of inspection.

When the wooden outfit is used, the ice can should be filled with cracked ice to provide refrigeration during transit. In no case should the sample itself be packed in the ice in this can; the bottle should be returned to its container and placed in position adjacent to the can. The can should never be used for the submission of samples of water for chemical or other examination.

Samples from newly constructed or recently cleaned wells should be identified as such; at least a week should elapse between the time water is first pumped and the collection of the samples. The well should be pumped frequently during the interim. From five to ten pails of water should be pumped from a well before a sample is collected. If there is any overflow or splashing back into the well during sampling, this fact should be recorded. Pails or buckets that are used for taking samples should be carefully cleaned and thoroughly rinsed with boiling water.

In ponds, reservoirs, or streams, samples should be taken in a sufficient depth of water to avoid disturbing the sediment or otherwise affecting the usual conditions. Grasping the bottle in the right hand near the bottom, plunge it mouth downward well under the surface, keeping the hand on the downstream side of the bottle; then carry the bottle upstream under the surface and out of the water, all in one continuous motion. Great care should be taken to avoid having the water flow over the hand into the bottle. The bottle should be plunged quickly below the surface and removed quickly to prevent entrainment of any surface scum. In rapidly flowing water the bottle may be held upstream and allowed to fill in this manner.

Samples for chemical analysis. The large bottle for the chemical sample is clean but not sterile. Selection of sampling

points should be made with the same care as in the collection of bacterial samples. The bottle should first be rinsed with the water to be collected, then filled with the sample, and precautions taken against the entrance of foreign material. If possible the sample should be collected directly, without the use of a pail, dipper, or funnel. If such apparatus is necessary it should be clean and thoroughly rinsed in the water to be sampled. Unless otherwise directed, the bottle should be filled to within two inches of the stopper, leaving only sufficient air space for expansion. The stopper* should be kept free from contamination as in taking the bacterial samples. The stopper and neck of the bottle should be re-covered with the cloth and tied securely. The ends of the string may then be sealed but never the stopper. Label the bottle with the name of the city, village, or town and the letters A, B, C, etc., to conform with the identification of the bacterial sample collected from the same source. Be sure that the proper descriptions of these samples are entered on the green, cherry, blue, or brown card on which are recorded the results of the sanitary inspection.

Samples from swimming pools and bathing areas. Samples of water from swimming pools and bathing areas are ordinarily examined only when submitted by a member of the Department staff in connection with a special study. A sterile bottle containing a dechlorinating agent is supplied for the collection of samples of chlorinated water. Any excess chlorine in the sample is thus neutralized and the examination indicates the bacterial content of the water more nearly than if the residual chlorine were allowed to remain in the sample during transit.

Sewage

Samples of sewage, sewage effluents, and industrial wastes are examined only when submitted by engineers or other members of the Department staff in investigations of the operation of sewage treatment plants or of stream pollution. They must be accompanied by the necessary identifying and descriptive data regarding the source, type of treatment, and method of plant operation at the time of sampling.

Samples for bacteriologic examination. Catch samples should be taken in the type of sterile bottle used for the collection of samples of water for bacteriologic examination. Samples of chlorinated sewage effluents should be collected in sterile bottles contain-

* If by accident the stopper of the bottle should become soiled, it may be washed thoroughly in the water being sampled and replaced in the bottle.

ing sodium thiosulfate to neutralize the residual chlorine in the sample. All samples must be carefully refrigerated and transported to the laboratory as rapidly as possible.

Samples for chemical analysis. Sampling points should be so located as to permit the collection of representative samples. Precautions against contaminating the sample with floating scum or sludge should be observed. Samples should be composites of specimens taken at intervals of not more than two hours, preferably more frequently, over a period determined by the nature of the investigation; when possible they should be integrated according to the rate of flow of the sewage. They should be submitted in duplicate in the glass-stoppered bottles (1 gallon capacity) furnished by the laboratory; concentrated sulfuric acid, C. P., (specific gravity 1.84) in the proportion of 1.5 ml. to one liter should be added as a preservative to one sample, and 5 ml. of chloroform per liter, to the second. If the biochemical oxygen demand is to be determined, a third unpreserved sample should be submitted. Samples should be refrigerated from the time of collection, and transported to the laboratory as rapidly as possible.

Sewage Sludge

Samples for chemical analysis. Samples of sewage sludge are examined only when submitted by the staff of the Division of Sanitation in their investigations of the operation of sewage treatment plants. Samples should be submitted in wide-mouthed, glass-stoppered bottles or in preserve jars, and must be accompanied by complete identifying and descriptive data regarding the source of both sewage and sludge and the type of treatment at time of sampling. Methods that ensure the collection of representative samples must be used. Samples should be refrigerated during shipment, and should be transported to the laboratory as rapidly as possible.

PART IV

EXAMINATION OF MILK AND CREAM

Samples of milk and cream are examined by the Division of Laboratories and Research only in special cooperative investigations with other divisions of the Department, principally the Division of Sanitation. Health officers requesting examinations to assist in carrying out the provisions of the Sanitary Code (Chap. III, Reg. 5) are referred to a local approved laboratory.

Bacteriologic examination. Before sampling, milk or cream should be thoroughly stirred with a sterile rod or by inverting the container. Samples of at least 25 ml. should be collected through sterile glass or metal tubes of a length sufficient to reach the bottom of the original container, and transferred to screw-capped vials or glass-stoppered bottles protected against contamination and leakage. Containers should be not more than two-thirds full in order to permit adequate agitation before portions of the sample are removed for examination. Bottled milk should be submitted in the original unopened container as distributed by the dealer. All samples should be shipped to a laboratory packed in sufficient cracked ice to ensure constant refrigeration during transportation. They should be accompanied by a record of the identification marks on the original container, the name and location of the dairy, bottling plant, creamery, producer, or distributor from whom the specimen was obtained, the date and time of collection and of shipment, the grade, whether raw or pasteurized, the examination requested, and any other pertinent information.

The standard agar-plate count provides information of value in the routine control of the sanitary quality of a milk supply and is essential to determine compliance with the standards of grading given in the Sanitary Code.

Direct microscopic examination detects unclean milk as well as that from cows with diseased udders. Since it yields valuable information concerning the bacterial and leucocyte content and may reveal the presence of flora introduced in processing, this method should be used in conjunction with the agar count on all samples, both raw and pasteurized. The direct microscopic count is not satisfactory for the accurate grading of Certified or other grades of raw milk with low counts; marked deviations from

these grades can be determined, however, and it is, therefore, a desirable auxiliary examination.

Under the usual conditions of production and handling, milk or cream may become contaminated with bacteria of the coliform group. Since these microorganisms multiply in such a favorable milieu, their determination in raw milk is of little value. Commercial pasteurization eliminates them, however, and their presence in pasteurized milk thus indicates subsequent contamination by faulty handling. The sanitary quality of all pasteurized milk and cream should therefore be checked by this examination.

Phosphatase test. The addition of significant amounts of raw milk to a pasteurized product cannot always be detected by bacteriologic examination, nor can variations in pasteurizing treatment. A laboratory procedure to detect irregularities of this character is essential in the control of the processing of milk. Experience has demonstrated that the phosphatase test detects almost without failure a lowering of as little as 1°F. in the temperature of pasteurization, shortening of the holding time by five minutes, and the addition of more than 0.1 per cent raw milk. It is thus exceedingly valuable in the control of pasteurization and should be made at frequent intervals.

In summary, the routine supervision of milk supplies should include the standard agar-plate count and the direct microscopic count on all samples, both raw and pasteurized; and, in addition, the test for the coliform group, and the phosphatase test on all pasteurized products.

The results of the examination of a single sample of milk or cream often do not fairly represent the character of a supply. If a particular sample has a high standard plate count and a phosphatase value indicative of inadequate pasteurization, or shows the presence of bacteria of the coliform group, an investigation should be made to discover the cause; additional samples should be examined to determine whether the results were indicative of a single faulty condition or whether the entire supply is intermittently or constantly below standard.

The determination of the butter fat content, solids, and preservatives in milk or cream is not made by the Division of Laboratories and Research, since the laws and regulations that relate to food value and adulteration are under the direction of the Department of Agriculture and Markets.

PART V

EXAMINATIONS CONCERNED WITH EATING, DRINKING, AND COOKING UTENSILS

A standard of 100 microorganisms per utensil surface area is established in the Sanitary Code (Chap. XIV, Reg. 3) as a criterion of the satisfactory cleansing of eating, drinking, and cooking utensils. Investigation has shown that adequate washing in water of 120°F., in which there is a suitable detergent, followed by adequate rinsing in water of 150°F. will satisfy this standard; and, further, that if such utensils are protected subsequently during storage against contamination by handling, they will be free from bacteria of the coliform group.

Laboratory examination of these utensils, particularly of glassware, is usually not necessary, since the methods of washing and rinsing and the general cleanliness of an establishment ordinarily indicate whether the regulations of the Code are met. Occasionally, it is necessary to demonstrate that specific methods produce or fail to produce results that meet the standard, and, in doubtful cases, to provide evidence regarding compliance with the regulations. When such examinations are required, the general sanitation of the establishment and information regarding the specific methods of washing and rinsing are necessary to an interpretation of the results, and should be furnished to the laboratory. The Code specifies that such examinations must be made in a laboratory approved for the purpose by the State Commissioner of Health.

PART VI

RECORDING AND REPORTING RESULTS OF LABORATORY EXAMINATIONS

The maintenance of accurate records of specimens received and the prompt and correct reporting of results of examinations are procedures of the utmost importance.

To facilitate handling and to eliminate any possibility of interchange in the laboratory, only one specimen is opened at a time; it is given a serial number before another container is opened. Accession books are kept for recording the receipt of specimens, pertinent data concerning them, and the results of examinations, thus safeguarding against loss or misplacement of specimens and unnecessary delays in sending reports. These books are also the source of statistics used in the compilation of monthly and annual reports. Typed reports of all examinations are checked with the accession books before being mailed, to ensure accuracy. They are sent to the physician by whom the specimen is submitted and, if the examination discloses the existence of a communicable or malignant disease, to the local or state health official to whom the physician is required to report the case (Public Health Law, Art. III, Sec. 25 and 25-b). A similar procedure is required (Public Health Law, Art. III, Sec. 25) when results of examinations are needed for purposes of release from quarantine or observation.

Copies of reports are sent to hospitals for purposes of record, if the physician makes such a request on the history form.

While the interests of the patient are considered in all cases where there is occasion to divulge information in regard to laboratory examinations, the Public Health Law (Art. XVII-B, Sec. 343-r) and the Sanitary Code (Chap. II, Reg. 26) require all records relating to suspected cases of syphilis, gonorrhea, or chancroid to be treated as strictly confidential. Copies of reports are therefore given only to health officials and to the physician by whom the specimen is submitted, unless the patient furnishes a waiver signed in the presence of a witness stating to whom he wishes the information furnished.

The Public Health Law (Art. III, Sec. 25, and Art. XVI, Sec. 322) and the Sanitary Code (Chap. II, Reg. 28-29) require records relating to cases of tuberculosis to be considered confidential also.

PART VII

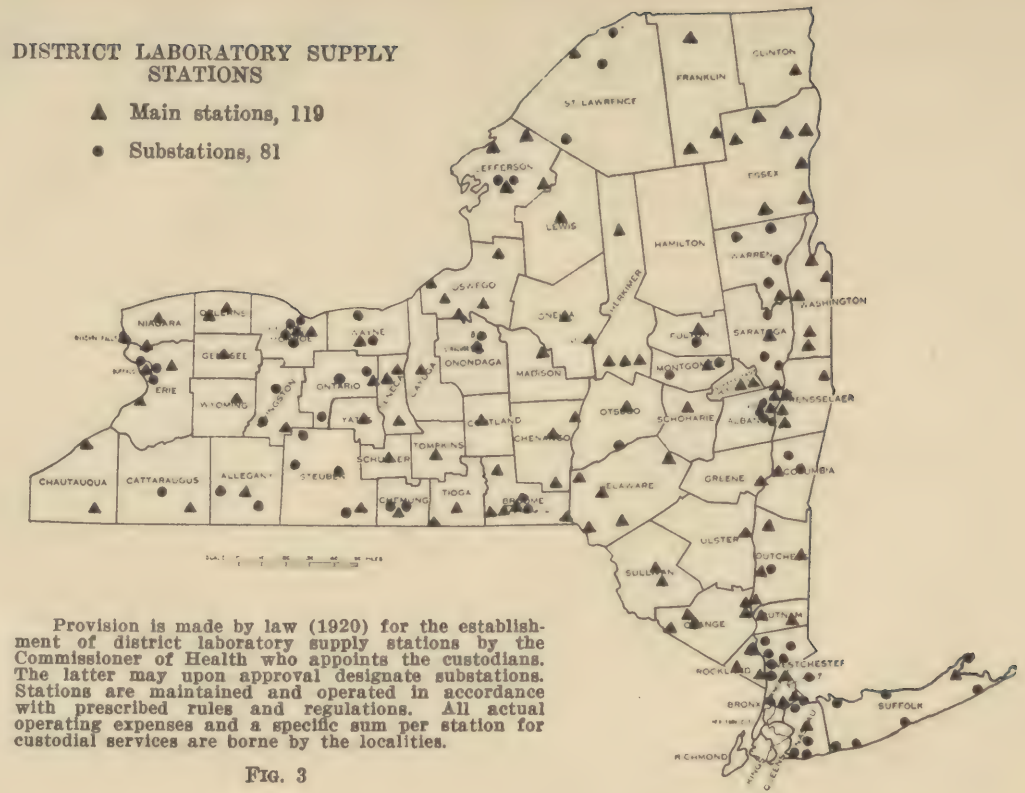
DISTRIBUTION OF LABORATORY SUPPLIES

Article II, Section 5, of the Public Health Law empowers the State Commissioner of Health or his authorized representative to establish district laboratory supply stations, to prescribe the district to be served by each, and to appoint a custodian to have charge of each station. A health officer or person in charge of a public health laboratory or, when necessary, some other competent person may be appointed. The law also authorizes the establishment of substations by the custodians upon approval of the State Department of Health. Substations should be established only in large cities and in counties where there is a county laboratory or a county health unit. All other stations should be main stations. If substations are essential for the satisfactory distribution of supplies to physicians in such cities and counties, they should be established only with the approval of the district state health officer and the central laboratory. The substations should be located where there are facilities for keeping supplies under proper conditions and should be placed in charge of qualified persons.

The law provides that each custodian of a main station shall be entitled to receive annually certain fees and the actual and necessary expenses for maintaining and operating the district station and its substations, upon certification of the State Department of Health that such stations have been maintained and operated in accordance with its rules and regulations.

District supply stations have been established throughout the State, and laboratory supplies, including outfits for diagnostic specimens and prophylactic and therapeutic preparations, with a few exceptions, are distributed through these district stations and their substations. (See Fig. 3, p. 103.)

Health officers and physicians should secure supplies required for immediate use from the station that serves the municipality in which they are located. In an emergency they should be procured from the nearest station. Laboratory supplies, especially the perishable products, should not be kept in quantity except in regularly established stations. If difficulties are experienced or delays occur, the matter should be taken up with the district custodian or, if necessary, with the Division of Laboratories and Research.



Provision is made by law (1920) for the establishment of district laboratory supply stations by the Commissioner of Health who appoints the custodians. The latter may upon approval designate substations. Stations are maintained and operated in accordance with prescribed rules and regulations. All actual operating expenses and a specific sum per station for custodial services are borne by the localities.

FIG. 3